THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

VOL. XXV MARCH, 1931 No. 3

TUBERCULOSIS OF THE INTERVERTEBRAL ARTICULATIONS*

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THE classical type of Pott's disease is readily diagnosed when the disease process is extensive enough to produce obvious clinical signs such as collapse of the diseased vertebra with a resultant kyphosis, or the pointing superficially of a cold abscess. Earlier recognition of the disease process is essential, however, to obtain a fair chance of a cure without deformity or secondary infection. The marked advance in roentgen technique, particularly in obtaining detailed lateral roentgenograms, has led to far earlier recognition of tuberculosis of the spine than can be made clinically. Today, two types of vertebral tuberculosis are recognized early, namely, the central involvement of the body of the vertebra, and the involvement of the anterior portion of the body with early bone destruction.

There is, however, a third type of tuberculosis of the vertebral bodies in which the diagnosis is frequently missed until relatively late in the process of the disease. This type has been called epiphyseal tuberculosis of the body of the vertebra because it involves the area of the body in which the epiphyses occur. Until recently it has been more of an anatomico-pathological concept than a clinical diagnosis. In our experience with our own cases and cases which have been seen elsewhere, the great source of failure of early recognition of spinal tuberculosis lies in this group. We have recently had 3 cases of this type in which earlier diagnosis should have been made. During the past ten years, we have seen annually a similar small group of this type in which the diagnosis was delayed. We believe that this type of epiphyseal tuberculosis presents certain clinical and roentgenologic features which serve to make it a well-defined syndrome, which, if looked for, will lead to far earlier diagnosis of the lesion.

Although the term commonly applied to this type of vertebral tuberculosis is "epiphyseal tuberculosis of the verbebral body," we believe that a better term would be "intervertebral articular tuberculosis," inasmuch as the disease occasionally occurs in this region after the epiphysis has united with the body, and as in some cases the lesion occurs away from the epiphysis. It is also a more descriptive term.

PATHOLOGY

It is generally recognized that tuberculosis of the spine is a local manifestation of a generalized tuberculous infection. Individuals so affected have probably acquired the infection in infancy or early youth, with the usual caseation of glands and generalized spread to various parts of

* Read at the Thirty-first Annual Meeting, American Roentgen Ray Society, West Baden, Ind., Sept. 23–26, 1930.

the body later in life. The spread of the infection to the various parts of the skeletal system, including the spine, is by the hematogenous route, although the lymphogenous route plays some part, and cases have been demonstrated at autopsy in which infection of the vertebral body occurred by continuity with a contiguous tuberculous gland. Kaufmann[4] says, "In those cases of periosteal tuberculosis of the vertebral bodies, in which paratracheal tuberculous lymph nodes are found, but no other tuberculosis in the body, Tenderloo believes that lymphogenous infection from these lymph nodes is the probable mode of origin."

The anatomic location of the infection in the vertebra would therefore be dependent almost entirely on the blood supply of the individual vertebra, except in those cases involved by continuity. Lexer[5] has studied the blood supply of the vertebrae by means of opaque injections and has shown it to be as follows: (1) The interior of the body of the vertebra is supplied by a branch of the posterior spinal artery entering the posterior border of the vertebral body. (2) The upper and lower articulating surfaces, just beneath the intervertebral discs, are supplied by the epiphyseal arteries which are branches of the posterior spinal artery. (3) The anterior portion of the body is supplied by minute branches of the intercostal artery entering through the anterior longitudinal ligament. (4) Branches from the intercostal vessels supply the neural arch and the transverse processes.

Various areas are involved, depending upon the distribution of the blood vessels carrying the infection: (1) Steindler[7] states that the central type constitutes the greatest proportion of cases in children. In this form there may be a minimum of symptoms until the necrosis has caused collapse of the body and consequent kyphosis. The destruction then involves the intervertebral disc and the adjacent vertebrae. (2) The epiphyseal type of involvement of the intervertebral articulation. In this type there is an early narrowing and disappearance of the disc with coaptation of the vertebrae. We wish to emphasize that early collapse of the body and kyphosis are not commonly seen and that abscess formation is frequently one of the first clinical findings. (3) The anterior or peripheral variety which occurs in the anterior portion of the vertebral body. This lies immediately beneath the anterior longitudinal ligament. The infection spreads along the surface beneath this, but may invade the body and then becomes identical with the central form. (4) More rarely the vertebral appendages may be involved.

Fraser[2] believes that the vertebra is predisposed to the tuberculous infection by a preliminary change in the main nutrient vessel. He believes that it is a tuberculous endarteritis obliterans, the result of a tuberculous toxemia, and that it affects usually the vessels supplying the vertebrae most liable to trauma and strain. Due to this blood vessel change the nutrition of the bone and marrow is interfered with and becomes fertile soil for the implantation of the tubercle bacillus. Typical tubercles develop which coalesce and finally form an area of caseation. In these caseous areas, necrotic bone trabeculae are found, either in communication with living bone or existing as sequestra.

According to Kaufmann these foci may be wedge-shaped with the base directed anteriorly, which is due to the blood supply and is probably the result of a sudden occlusion or an obliterating tuberculous endarteritis with previous dissemination into the area supplied by the vessel. Very little periosteal new bone formation is observed in tuberculosis of the vertebrae unless there is sinus formation with consequent secondary infection.

In the central form there is early excavation in the body, and because of the transmitted vertical pressure upon it, the normal form of the bone cannot be maintained. There is a consequent collapse of the body of the vertebra with the posterior articulations remaining *in situ*, which produces the characteristic kyphosis seen in so many advanced cases. It should be noted that in

this type the disc is destroyed rather late in the course of the disease, usually after the adjacent vertebra is involved. This course of events also occurs in a certain number of cases of the anterior peripheral type.

In the intervertebral articular type, however, the story is entirely different. Here the process begins along the articular margin where the disc is attached. The normally poor circulation of the disc is soon destroyed and there is early disappearance of this with approximation of the vertebrae. The essential difference here is that the vertebral body form is preserved intact until late in the disease when the destruction has progressed to a point where there is excavation of the center of the body. The disease is frequently unrecognized for a sufficient period of time for an abscess to develop and point superficially.

ROENTGEN CHANGES

One of the first roentgen signs of tuberculosis of the spine is narrowing of the intervertebral disc, which may become quite marked before there are noticeable changes in the vertebrae. This is rather strange when it is realized that pathologically the lesion begins in the vertebral body and spreads from this. Technically, the narrowing of the disc is so easy to show as compared with minute bone changes that this may explain most of the discrepancy in the findings. Sgalitzer[6] has recently reported a number of early cases which showed various degrees of narrowing of the disc before changes were noted in the bodies. The changes noted in the vertebral body roughly correspond to the pathological types mentioned above. The most characteristic picture of the late stages is that of destruction and collapse of the bodies anteriorly with obliteration of the discs and a consequent kyphosis.

These extensive changes may not be present, however, and in the earlier cases the first bone changes may be minute localized erosions, or even a slight blurring of the sharp contour of the body. Either alone or combined with these changes may be found various degrees of condensation of bone with loss of the trabecular markings. This usually extends distally from the margin of the area of destruction.

In the intervertebral articular type, the earliest demonstrable change is narrowing of the intervertebral space. The early bone changes consist of a small erosion or roughening along the articular surface, or a small localized area of destruction beginning at the articular margin and later extending into the body. In these cases there is a preservation of the normal size and shape of the body until the late stages, when it has invaded the body, and it then shows the characteristics of the central type. Due to the preservation of the vertebral body there is no kyphosis or other deformity.

In one of our typical cases (Case I) there was a definite narrowing of the intervertebral disc. The contour of the adjacent bodies remained normal but there was an area of destruction involving the upper posterior portion of the body of one vertebra. There was no kyphosis. In another case (Case III) there was obliteration of the intervertebral disc with a definite destructive process involving the middle portion of the adjacent articular surfaces. An abscess was present and there was a small sequestrum lying in the diseased area between the two vertebrae. In a third case (Case II) there was narrowing but no obliteration of the disc. There was an area of destruction involving the upper margin of one vertebra and a smaller eroded area on the inferior margin of the adjacent vertebra.

Abscess formation is the most common complication of spinal tuberculosis, and its early recognition is very important in view of the fact that it may give the first intimation as to the true nature of the disease. In our series several cases developed abscesses which led to a careful roentgen study of the spine with the resultant disclosure of an early tuberculous lesion.

Abscesses originating in the thoracic spine are relatively easy to demonstrate roentgenologically, but clinically are some-

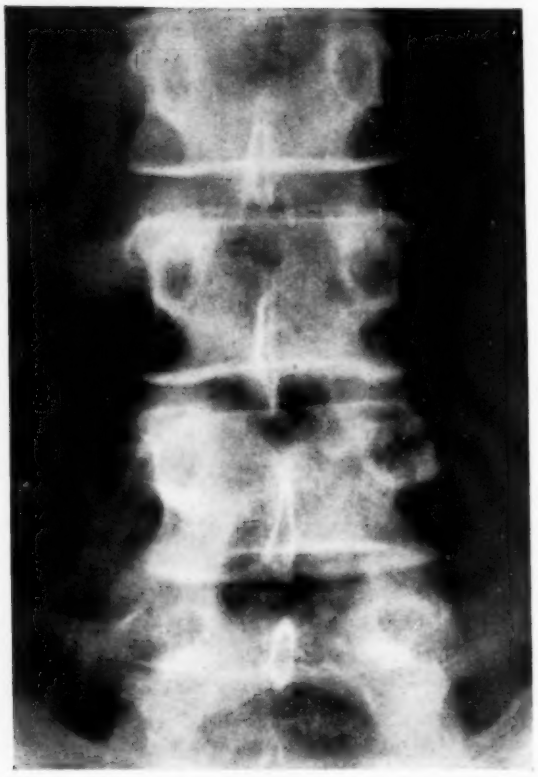

Fig. 1. Case 1

what more elusive. In this area, owing to the fact that the diaphragm exercises a restraining influence on the downward passage of the pus, abscesses are usually fusiform or globular. Cases treated in the recumbent position are likely to show the abscess at and above the spine lesion rather than below. The abscess may overlie the cardiac shadow but can easily be seen on films of proper density. The abscess spreading along the spine beneath the anterior longitudinal ligaments may infect adjacent vertebrae, but Ghormley and Bradley[3] believe that some of the cases showing a smooth anterior erosion may be due to a mechanical erosion by a transmitted pulse from the aorta through the abscess similar to the erosion seen in aneurysm.

In the lumbar area the most common route for the migration of the pus is within the fascia of the iliopsoas or of the quadratus lumborum muscle, causing a bulging shadow which is quite characteristic when seen. These, however, are not demonstrable with the same frequency as the abscesses occurring in the thoracic area.

CASE REPORTS

Case 1. J. M., a white schoolboy, aged fifteen. Complaint, severe pain and muscle spasm in the low back.

In April, 1927, the patient contracted pleurisy with effusion. In May, 1928, there was a sudden onset of low back pain, scoliosis, and marked muscle spasm. Roentgenograms of the spine and chest at this time were negative. In one week there was apparent recovery. In December, 1928, there was a mild influenza, following which the patient became easily fatigued and thereafter lived a much quieter life. In March, 1929, there was recurrence of the back symptoms. In April he was seen by a competent orthopedist who found the spine to be negative.

Due to a persistent temperature of 100°F. in the afternoon, his home physician felt that tuberculosis should be considered and applied

Fig. 2. Case 1

a plaster jacket in May, 1929. The cast did not seem to relieve him and it was removed.

On June 28, 1929, the patient was admitted to the Henry Ford Hospital. Physical examination revealed limitation of motion in the lower lumbar spine with definite splinting of the back. There was no evidence of kyphosis or lateral deformity. Straight leg raising caused pain in the hamstrings, but not in the back. There was no localized tenderness over the spinous processes, and no evidence of abscesses. The tendon reflexes were normal.

Examination of the chest showed slight prolongation of expiration at the right apex. The chest was otherwise negative, both clinically and roentgenologically.

Roentgen examination of the lumbar spine revealed slight narrowing of the intervertebral disc between the third and fourth lumbar vertebrae, with an area of bone destruction involving the upper posterior margin of the fourth lumbar vertebra (Figs. 1 and 2).

The patient was treated on a Bradford frame and by recumbency until November 1, 1929,

Fig. 3. Case II

Fig. 4. Case II

when an Albee bone graft was performed. Treatment on the Bradford frame was continued until recently. He is apparently well and free from symptoms.

Roentgen examination at this time shows some evidence of bone repair. There has been no further extension of the disease process.

Case II. D. M., white male, aged twenty-four. Complaint, pain in the low back over the left sacroiliac region and radiating down the back of the left leg.

The onset was in May, 1929, with a gradually increasing pain which did not incapacitate him for work until about two weeks previous to his admission which was May 30, 1929.

Physical examination revealed a well-nourished, well-developed male. There was a scar beneath the right mandible resulting from the removal of cervical glands. The chest was long and slender, but negative. The right epididymis was slightly thickened and tender. The back was held rigidly in the deformity of a total left scoliosis with marked muscle spasm of the left erector spinae muscles chiefly. In

forward bending, the spine deviated to the left and flexion was quite limited. Right lateral bending was markedly limited. Left lateral bending was normal. There was some tenderness on pressure over the left posterior sacroiliac ligaments. The chief symptomatology was in the left sacroiliac region, with radiation down the back of the left leg.

Roentgen examination of the fifth lumbar vertebra and sacroiliac area was negative for bone pathology.

A bivalved plaster jacket was applied, and diathermy and massage were employed with complete relief of symptoms in one month.

In February, 1930, the patient reported back stating that he had been free from pain until two months previously. There was marked muscle spasm with restriction of motion of the entire spine. This was so marked that an extensive arthritis, similar to a spondylitis, was considered as the probable diagnosis. A Taylor back brace was applied. In April the patient returned with a cold swelling the size of a small lemon just to the left of the lumbar spine at the triangle of Petit.

Roentgen examination of the lumbodorsal spine revealed narrowing of the intervertebral disc between the twelfth dorsal and the first lumbar vertebrae, and a lesion along the upper articular margin of the first lumbar vertebra together with a suggestion of a very slight lesion on the under surface of the twelfth dorsal. The psoas muscle shadows could not be made out on these films (Figs. 3 and 4).

Recumbent treatment was begun at once. The abscess was aspirated and a guinea pig injected, with death of the guinea pig two months later from miliary tuberculosis of the spleen, liver, and inguinal glands.

On August 15, 1930, an Albee bone graft was performed. The patient is doing well and is being treated in the recumbent position in a plaster jacket.

Case III. F. V., white female, nurse, aged twenty-six. There was a history of recurrent attacks of low back pain relieved by adhesive strapping in 1926. In December, 1927, after a severe cold, the back symptoms recurred, chiefly in the left sacroiliac area, but were relieved by a sacroiliac belt. In August, 1928, the patient caught cold following which she became easily fatigued and had recurrence of back symptoms. Roentgenograms of the chest were negative. Roentgenograms of the lumbar spine and sacroiliac joints were also negative.

She was treated by recumbency on a board mattress, and later a plaster jacket was applied. Her condition did not improve under this treatment.

In December, 1928, she was seen by a competent orthopedist who made a diagnosis of tuberculosis of the sacroiliac articulation and advised arthrodesis of this joint.

In April, 1929, she first visited us for confirmation of this operative procedure. Clinical examination showed no deformity of the spine. Flexion of the spine was normal, but hyperextension produced pain over the lumbosacral joint. The posterior left sacroiliac ligaments were tender but straight leg raising and hyperextension were normal. Films of the lumbosacral and sacroiliac joints brought in by the patient were found to be negative. It was therefore felt that the involvement was higher up and the patient was given a lumbar corset. She then went to her home in the country where she lived a very active outdoor life for several months and seemed to improve.

Fig. 5. Case III

In October, 1929, she reported that recently pain had returned and there was a tender area in the right lumbar region. Clinical examination revealed a marked tumefaction consisting of a fluctuating area near the right costovertebral angle. There was now local tenderness on percussion over the second lumbar vertebra. There was not much limitation of motion in the spine. The chief limitation was in hyperextension.

Roentgen examination of the chest on October 1, 1929, revealed no evidence of any lung pathology. Roentgen examination of the entire spine at this time revealed a definite narrowing of the discs between the first and second lumbar vertebrae. There was also an area of destruction along the lower articular margin of the first lumbar vertebra and the upper articular margin of the second lumbar vertebra. There was a small sequestrum along the upper margin of the second lumbar vertebra (Figs. 5 and 6).

The abscess was aspirated and a guinea pig injected. This resulted in death of the guinea pig two months later from miliary tuberculosis of the spleen, liver, and glands. Acid-fast bacilli were found in the smear.

Fig. 6. Case III

In the meantime the patient was put on recumbent treatment on a Bradford frame as a preoperative procedure. On November 12, 1929, a number of moist râles were found in the right axilla, and films showed a small area of parenchymatous involvement in the second interspace. At this time the patient was discharged to her home, on a Bradford frame plus a bivalved cast. She returned in September, 1930, with a gain of 30 pounds in weight. The abscess had been lanced by her home physician and is still draining. Clinically the chest condition was healed. A bone graft was performed on September 12, 1930.

DISCUSSION

In the three cases presented, we see a clinical picture of a syndrome in which the outstanding features are common to all of the cases. The ages of the patients vary between fifteen and twenty-five. The site of the lesion is in the lumbar spine. There is a rather prolonged prodromal stage of repeated attacks of severe backache radiating to the region of the sacroiliacs and down the back of the leg. The pain symptoms were all below the level of the lesion. Periods of apparent complete remission from pain, allowing resumption of activity, were present in the three cases.

The possibility of a former tuberculous process elsewhere was demonstrated in two cases, one a cervical gland involvement requiring operative procedure, and one a pleurisy with effusion. The third case developed pulmonary symptoms and signs while under observation.

The tuberculous nature of the spinal lesion was proved positively in two cases by guinea pig inoculation from the cold abscess material.

The presence of a marked abscess formation was noted in two cases. The early diminution of the intervertebral space was noted in all three cases.

No spinal deformity was noted in any case, with the exception of a temporary scoliosis, which disappeared under rest.

In conclusion, we believe that a young adult giving symtoms of recurrent attacks of low back pain, sometimes associated with a temporary scoliotic deformity, should have a thorough investigation. A careful history investigating the possibility of a previous tuberculous infection should be taken. Roentgenograms including the thoracic and the entire lumbar spine should be made and careful attention paid to any narrowing of an intervertebral disc. If there is any evidence of a tuberculous process, the individual should be treated as possibly having a tuberculous spine, and should be frequently reëxamined, clinically and roentgenologically.

One word of caution is especially necessary in this group because of the fact that the symptomatology points chiefly to a possible sacroiliac lesion. The roentgen appearance of the sacroiliacs in individuals of this age may be misinterpreted as pathological because of the frequent widening and haziness of the joint which is noted at this period.

SUMMARY

Tuberculous infection of the spine usually occurs by the hematogenous route.

The various types of spinal involvement are described depending upon the blood supply.

Emphasis is laid upon tuberculous involvement of the intervertebral articulations.

In this type early clinical diagnosis is difficult because of lack of deformity, and the roentgen examination must be the chief reliance for early diagnosis.

The early roentgen signs are narrowing of the intervertebral disc together with erosion of the articular surfaces, but with preservation of the body form.

Three typical case histories are presented.

REFERENCES

1. Calvé, J., and Galland, M. Ostéites vertébrales centrosomatiques et mal de Pott; les aspects "en dent creuse." *Presse méd.*, 1927, *35*, 1377–1378.
2. Fraser, John. Tuberculosis of the Bones and Joints in Children. The Macmillan Co., New York, 1914.
3. Ghormley, R. K., and Bradley, J. I. Prognostic signs in the x-rays of tuberculous spines in children. *J. Bone & Joint Surg.*, 1928, *10*, 796–804.
4. Kaufmann, Edward. Pathology for Students and Practitioners. Translated by S. P. Reimann. Vol. II. P. Blakiston's Son & Co., Philadelphia, 1929.
5. Lexer, E., and Kuliga, P. Untersuchungen über Knochenarterien mittelst Röntgenaufnahmen injizierten Knochen und ihre Bedeutung für einzelne pathologische Vorgänge am Knochensysteme. A. Hirschwald, Berlin, 1904.
6. Sgalitzer, Max. Röntgenologische Studien zum Nachweis der Wirbeltuberculose in einem frühen Stadium. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1929, *40*, 761–786.
7. Steindler, Arthur. Diseases and Deformities of the Spine and Thorax. C. V. Mosby Co., St. Louis, 1929.

DISCUSSION

Dr. E. S. Blaine, Chicago. When I first learned that I was to discuss Dr. Doub's paper, the title given was different from the present one. I knew relatively little about vertebral epiphysitis the original subject, but after some study came prepared to discuss that subject rather than tuberculosis of the intervertebral discs and the epiphyseal portions of the vertebral bodies. I did have an opportunity just before coming here of looking over Dr. Doub's very able paper, and consider it a splendid work and very interesting.

Predominantly, tuberculosis involving bones is a matter of epiphyseal invasion. It is rather unusual, at least in my experience, to find an original focus of tuberculosis in a diaphysis. If it does involve a diaphysis, it is usually by extension from an original epiphyseal invasion. I stress this point having in mind that Dr. Doub has shown us so beautifully evidence that supports this particular point.

For some time I have been impressed with the difference which the roentgen manifestations of tuberculosis of a vertebral body show from that of freely moving joints. Of course, a vertebral joint isn't really a joint as there are no sliding surfaces. Therefore, I wondered many times why it was that when we got a

tuberculous involvement of a vertebral body, it was the central or diaphyseal portion that was involved. This paper has opened my eyes. I may be unstudied or inexperienced in this particular subject, but I have been very much impressed by the presentation as it explains the fact that manifestations are no different in the spine than in other joints of the body, but that the roentgen ray doesn't show the changes which occur in the early stages of the lesion. If the roentgenologist is to be of real value to the referring physician, he must find roentgen evidence of pathology early and not late. The roentgen disclosure of a very far advanced tuberculosis, whether it be of a joint or of the lung, isn't of any great value, but to catch it in the incipient or early stages is something worth while and it is this that has been exceedingly well shown in this paper. I think it a splendid contribution to our knowledge on the subject.

Concerning the blood supply of a vertebral body, Lexer, whom Dr. Doub has quoted and who did the injections revealing the blood supply, shows a different situation than is given in certain authoritative books on the subject. In the German work referred to, it is stated that the main, principal blood supply is an artery entering the vertebral body from the front at its middle while Lexer has shown in the diagram that Doctor Doub showed us a few moments ago on the screen that its principal artery enters posteriorly while these smaller ones enter in front. Having seen the roentgen shadow of the nutrient artery in each one of the vertebral bodies of the entire spinal column enter from the anterior surfaces, I regarded this as the reason why tuberculosis causes the bone necrosis and the consequent bone collapse, anteriorly resulting in the familiar truncated cone or, in the extreme cases, the triangular outline of body because of the greater support behind afforded by the articular facets and associated structures. The anterior collapse follows softening and pressure from above and from below. Dr. Doub's presentation will cause us to look for a different explanation than that which I have just given.

There is a short period or stage in the life of a growing individual when the roentgenogram will show the epiphyseal plates above and below the diaphysis, that is, the body; this is further proof in support of Dr. Doub's paper. The narrowings of the intervertebral spaces which we sometimes see on lateral films of the spine may well be due to an early stage of spinal tuberculosis. If I learn nothing else in this meeting, the information given by Dr. Doub and Dr Badgley is well worth while having come for

CONDITIONS COMMONLY CALLED COLITIS*

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WHEN every patient with intestinal dysfunction is subjected to careful clinical and proctoscopic or roentgenologic investigation, many more serious disorders of the colon will be brought to the attention of physicians during the time when the disorders are curable and often in their incipiency. Conversely, when the term "colitis" is applied only to infectious and inflammatory lesions of the large intestine, untold physical and mental anguish and suffering will be eliminated. It is a term all too freely applied in recent years to various forms of indeterminate abdominal discomfort, either associated with, or quite apart from, demonstrable intestinal dysfunction.

Colitis, according to the etymology of the word, refers to an inflammatory disease of the colon. In modern medicine, it should be applied only to infectious diseases of the colon. The known infectious colonic diseases include chronic ulcerative colitis, bacillary dysentery, amebic colitis, tuberculous colitis, an ulcerative phenomenon in the large intestine, occurring with the partaking of unusual quantities of arsenic, mercury and lead, and as a terminal event in uremia, as well as such rarer infestations as those by *Balantidium coli*.

The terms "mucous colitis" and all its synonyms listed by Barker and Crane, such as "mucous colopathy," "myxorrhea membranacea," "pseudo-membranous enteritis," "myxomembranous colitis," and "spastic colitis," do not designate colonic disease, as most students of the subject admit, but rather parts of a general bodily state. They have been discussed as intestinal maladies, much to the confusion of physicians, but particularly to the confusion of patients. According to present clinical and pathologic data, they are not primary intestinal diseases, and a designation should be applied to them which gives at once an impression of general disability, whether functional or organic.

It seems likely that the last chapter on the dysfunction known as "mucous colitis" has not been written. Particularly does this become likely in view of the more recent evidence of bacterial sensitivity in these cases, as pointed out by Dorst. However, until more definite pathologic and clinical evidence of the infectious nature of this syndrome can be advanced, such a term as "irritable colon" would seem more to the point. This term suggests at once that the intestinal disorder is only a part of a general disorder, and leads one to investigate not only the colonic difficulty but the basic trouble. It further suggests the trend of therapeutic endeavor and tends to take the patient's thought away from the colon.

Munthe in his popular description of the life of San Michele made much of the fascinating malady colitis, which to him was only a word to soothe the anxious minds of his Parisian society women.

Wiltsie has advocated colonic irrigations for symptoms which he ascribed to colonic stasis, including mental and physical depression, dizziness, headaches, loss of weight, constipation, loss of appetite, and insomnia.

The "string sign" of Crane has been presumed to be indicative of "mucous colitis." The sign consists in a thin line in the roentgenogram, along the course of the colon, and probably is caused by barium adhering to mucus in the bowel. And yet, in a large series of cases of so-called mucous colitis seen at The Mayo Clinic, my colleagues and I have not been able to establish it as pathognomonic evidence solely of colonic disturbance. Clinical evidence rather prevented our laying too much stress

* Read at the Thirty-first Annual Meeting, American Roentgen Ray Society, West Baden, Ind., Sept. 23–26, 1930.

on objective data regarding the intestine. The syndrome of mucus in the stools, with intestinal irritability, may be the result of many factors, the basis of which usually will be found in parts remote from the colon, as will be shown in subsequent statistical study. Men have recognized the importance of the nervous system in so-called mucous colitis and have called attention to roentgenoscopic evidence of changes in the colon in a condition which perhaps finds its primary cause in a patient's make-up. Kantor has added to knowledge of the roentgenologic evidence of certain forms of irritable colon.

Tidy decried the use of medicated enemas and starvation, that are in such common use in this condition; he maintained that these are measures which would induce colitis in many healthy persons.

Barker has dwelt on the invariable association of this enteropathy with a neuropathic constitution. He has preferred to call it mucous colopathy, and has expressed the belief that it is primarily neurosis, a view shared by Bockus, Bank, and Wilkinson.

The symptoms of the condition known as mucous colitis are extremely varied. They are associated either with constipation or diarrhea, with abdominal pains of various types, often along parts of the line of the large intestine, and with various mild or severe affective disorders.

Friedenwald, Feldman and Rosenthal, in a review of 500 cases of so-called mucous colitis, failed to present a picture clearly directing attention to the colon. They felt that many factors enter into the etiology of the condition but that it manifests itself mainly in cases in which instability of the nervous system prepares the patient for the condition. They made note of the fact that the vegetative nervous system supplies two sets of nerve fibers to the gastrointestinal tract, one functioning as activator nerves, the other, as inhibitor nerves. Stimulation of the parasympathetic system causes increased secretory and motor activity of the bowel, leading to excessive formation of mucus and to colic.

It must be remembered, however, that one of the prime functions of the cells lining the large intestine is secretion of mucus, and that the amount of this secretion will vary directly with the amount of intestinal irritation provided and with the sensitivity of the nervous mechanism involved.

Brown, in a detailed study of the subject of colitis, has condemned the use of such terms as mucous colitis, spastic colitis and toxic colitis. These designate, he believes, not inflammatory colonic disease but rather general bodily conditions, in which the symptoms referable to the colon provide only a small part of the general symptoms.

Hurst, in the opening paper in a discussion on colitis said: "No diagnosis is made more frequently and with less justification," and continued, "In most cases in which colitis is diagnosed, a name indicating a definite organic disease is given to explain the presence of symptoms which are purely functional, and much money and time are spent on vaccines, intestinal douches, and visits to spas when nothing more than a little judicious psychotherapy is really required.

"On the other hand, the same diagnosis is often made when a much more serious condition, cancer of the colon and rectum, is really present, and weeks or months are allowed to pass with futile bacteriological or local treatment until all chances of cure by radical operation are lost."

Because this agreed somewhat with clinical experience at The Mayo Clinic as well as with Weber's roentgenologic observations, my colleagues and I have studied carefully records of several thousand cases in which a diagnosis of colitis was made before the patients came to the Clinic and in which we were unable to demonstrate evidence of colitis. Of these, 200 consecutive cases have been studied statistically.

The ages of the patients in these 200 cases ranged from twenty-two to seventy-eight years, but most of them were in the third or fourth decade of life. Civil state was of little significance, although some outstanding exceptions made us suspect,

by cursory inspection, that the condition occurred more commonly in middle-aged single women and bachelors. Closer study failed to confirm this. Fifty-eight per cent of the patients were women, and 42 per cent were men, but it seems doubtful whether such figures would stand if the entire series of several thousand patients were considered.

Occupation seemed to have a definite bearing on the incidence of these complaints. There were teachers, priests, preachers, students, lawyers, salesmen, merchants, draftsmen, and a few gang foremen and farmers. Nationality seemed to be of little significance.

All the patients had definite symptoms of neurosis. Some patients gave a history of much nervous strain, anxiety, worry, intolerance of the presence of crowds, excessive physical or mental effort, introspection, insomnia, unhappiness with their lot, family difficulties, excessive use of tobacco or liquor and dissipation in one form or another. Many other nervous phenomena tended to precipitate the abdominal complaints.

There were common complaints of headache, vertigo, coarse tremor of the hands, breathless awakening at night, chewing of finger nails, grand mal, fainting at work, nausea, rapid talking, and weak and tired sensations. In some cases complaints present were definitely referable to recurrent appendicitis; cholecystitis without stones, or sometimes, with stones; tuberculous peritonitis; arthritis with myositis, and a relatively small number of malignant lesions.

The cases divide themselves definitely into three groups: (1) those in which there was diarrhea, or loose, sometimes frequent, stools; (2) those with obstinate constipation, and (3) those with organic disease such as carcinoma, without other inflammatory lesions.

The common abdominal complaints in the cases with diarrhea or loose stools included attacks of sharp, severe cramps in the middle and lower parts of the abdomen, followed by liquid stools, uncomfortable sensations in the left side of the abdomen, periods of constipation followed by taking a laxative, and then several days of uncontrollable diarrhea, bloating, distention with gas, and passage of mucus varying from flecks to large, tubular casts. Unusual emotion or dietary indiscretion might precipitate an episode of diarrhea. Dieting for various conditions, such as facial acne, was given in not a few cases as the initial cause of the diarrhea. Localized symptoms were the exception, irregular to generalized discomfort was the usual story, and this often in association with innumerable complaints of abnormality in other parts of the body.

In general, abdominal complaints in the cases with constipation were similar to those in cases with diarrhea, except that in these there was difficulty in moving the bowels, often the result of inadequate dietary habits, or of use of purgatives or enemas. The stools might be scybalous, or, from the patient's standpoint, evacuations might be insufficient. In these cases, varying quantities of mucous discharges were common.

Little need be said about the third group of cases in which a diagnosis of colitis was made when a more serious lesion, such as a malignant growth, was present. This usually was found at or near the rectosigmoid juncture of the large intestine, perhaps too high for digital examination and difficult to visualize roentgenologically.

In these cases of so-called colitis loss of weight was common, varying from 5 to 35 pounds. This was usually ascribable to change in dietary habits. A few patients had gained weight. Examinations included metabolism tests in a few cases, and in all, roentgenologic studies of the thorax and colon, sigmoidoscopic and proctoscopic examinations, and examinations of stool. Analysis of gastric contents was made when indicated, especially in the cases of diarrhea. Results of metabolism tests, when made, usually were below the base line of zero, and varied between -1 and -14 per cent; they probably were of little, if any, significance.

Eight per cent of patients had pulmonary lesions that roentgenologically were suggestive of healed lesions of tuberculosis.

Roentgenologic studies of the intestine after barium enema disclosed diverticulosis in only 4 per cent of cases. Proctoscopic examinations revealed normal mucosa in all cases, and among the positive findings were anal fissures, bleeding anal crypts, and relaxed, or lacerated and scarred anal sphincters. Two to four examinations of stool, on as many successive days, were negative for parasites and ova in about 90 per cent of cases. In the 10 per cent of results which were graded as positive the parasites found included *Chilomastix mesnili*, *Endolimax nana*, *Endamoeba coli*, and *Giardia intestinalis*. The pathogenic significance of the organisms, except for the last, which was found in only a few cases, is questioned by many authorities.

Following out of a definite program in the investigation of any complaint of intestinal dysfunction is of paramount importance. At the Clinic, the following sequence is employed: anamnesis, general examination, in which is included digital examination of the rectum, examination of stool, proctoscopic and sigmoidoscopic examinations, and roentgenologic study.

The importance of careful history taking cannot be overemphasized. It is often the most useful means employed, and in such a series of cases as these is often the only significant diagnostic step, except as the objective tests give negative data. One must often listen to an elaborate and often painfully long recitation of complaints. The patient should be encouraged, as Brown has emphasized, to tell all he can of the various phases which constitute the background for the intestinal upset. It may require fortitude to listen to the troubles of the nervously exhausted patient but I know of no form of neurosis in which patience is of more importance than that related to troubles which the patient refers to the intestine. The patient must be taken into whole-hearted confidence. His habits of eating should be gone into very thoroughly.

Having satisfied one's self that all the information one can obtain at the first visit has been recorded, it may be wise to dismiss the patient and have him return subsequently for further consideration. In the meantime, however, it is usually best to outline a program of laboratory investigations which can be begun at once and carried along in regular sequence. Gross and microscopic examination of the stools is best carried out before any interference with intestinal habits has taken place, as in preparation for proctoscopic and roentgenologic studies. Because of the adherence of barium to the rectal lining, sometimes for days, proctoscopic examination is probably best undertaken after examination of the stool.

The negative information obtained by the use of the sigmoidoscope is invaluable. Hurst, in considering mucous colitis wrote: "I have repeatedly sigmoidoscoped patients with this condition and I have never seen the slightest sign of inflammation, unless they have been treated with irritating douches." This, in general, agrees with the data submitted by Buie and his associates.

Finally, careful roentgenologic investigations are undertaken. Experience has shown the barium enema to be far superior to the meal. There are cases in which it seems wise to watch the progress of barium given from above, particularly in cases of questionable ileocecal function, but in many cases this will be superfluous.

Analysis of gastric contents has been found of value in only a small group of cases.

Treatment in these cases is not within the scope of this paper. Suffice it to say that here again patience and fortitude are most important. The problems are often individual and usually must be dealt with as part of a condition of general debility, with relatively less emphasis on the intestinal dysfunction.

SUMMARY

The word "colitis" has frequently been used to describe various types of intestinal dysfunction in which there is no demon-

strable organic disease of the large intestine. In cases of suspected intestinal disease, painstaking and detailed anamnesis is of first importance. When discomfort or pain is present in the lower part of the abdomen, the possibility of some disorder of the colon requires consideration. A regular routine of objective investigations is of great value in determining the presence or absence of disease. Roentgenologic studies have value in excluding from consideration intestinal neurosis which may be expressed in the conditions known as mucous colitis, spastic colitis and irritable colon. Colitis is an inflammatory disease of the colon and should not be diagnosed until thorough investigation has shown that inflammation, nothing less and nothing more, is present. Some other term, suggestive of part of a general bodily state, perhaps irritable colon, should designate the noninflammatory colonic disorders.

REFERENCES

1. Barker, L. F. On the concomitants of the intestinal malady commonly known as mucous colitis; (pseudomembranous mucous colopathy; myxoneurosis intestinalis). *Proc. Internat. Assemb. Inter-State Post-Grad. Med. Assembly* (1928), 1929, 526–530.
2. Barker, L. F. On the management of spastic colon and mucous colopathy, especially in hypervagotonic persons. *Am. J. M. Sc.*, 1929, *178*, 606–615.
3. Bockus, H. L., Bank, Joseph, and Wilkinson, S. A. Neurogenic mucous colitis. *Am. J. M. Sc.*, 1928, *176*, 813–829.
4. Brown, P. W. Colitis and so-called colitis. (In press.)
5. Buie, L. A. Personal communication.
6. Crane, A. W. A roentgenological sign of mucous colitis. Am. J. Roentgenol. & Rad. Therapy, 1927, *17*, 416–425.
7. Dorst, S. E. and Morris, R. S. Bacterial hypersensitivity of the intestinal tract; its treatment with autogenous vaccine and sodium ricinoleate. *Am. J. M. Sc.*, 1930, *180* 650–656.
8. Friedenwald, Julius, Feldman, Maurice, and Rosenthal, L. J. Mucous colitis; observations in 500 cases. *Ann. Int. Med.*, 1929, *3*, 521–545.
9. Hurst, A. F. A discussion on the diagnosis and treatment of colitis. *Lancet*, 1926, *2*, 1151–1154.
10. Kantor, J. L. Colon studies. IV. The roentgen diagnosis of colitis (the irritable colon). Am. J. Roentgenol. & Rad. Therapy, 1927, *17*, 405–416.
11. Munthe, Axel. The Story of San Michele. E. P. Dutton and Co., New York, 1930.
12. Osler, William, and McCrae, Thomas. The Principles and Practice of Medicine. Ninth edition. D. Appleton and Co., New York, 1920.
13. Tidy, H. L. Diagnosis and treatment of catarrhal and ulcerative colitis. *Brit. M. J.*, 1930, *2*, 135–150.
14. Weber, H. M. Discussion. *Proc. Staff Meet. Mayo Clin.*, Sept. 17, 1930, *5*.
15. Wiltsie, J. W. Colonic stasis and colonic therapy. *Am. Med.*, 1929, *24*, 745–751.

DISCUSSION

Dr. Henry K. Pancoast, Philadelphia. It has happened so often in the history of diagnostic roentgenology that we have allowed our imagination to carry us away and we have been awakened finally by such a paper as that just heard. Some of us have often made erroneous diagnoses in calling conditions colitis which are not colitis. It has been only recently that we have begun to get away from the diagnosis of chronic intestinal stasis by means of roentgenological study. It is rather hard even yet not to use that term, but I certainly would not take any roentgenologist's word for such a diagnosis on my own person, neither do I think it is possible in any case that it is put in a hospital to make a correct diagnosis of that condition.

The term "irritable colon" is a most excellent one and I am very glad to know that we can include within this term even those cases which in the past we have diagnosed as mucous colitis. I was very glad indeed to see that one of the last slides showed the appearance so often interpreted as mucous colitis, that is, the mucous string, due to causes which were entirely foreign to any disease of the colon.

It has happened very often that I have seen diagnoses of so-called chronic colitis made on the basis or the absence of haustrations during the barium enema. I have never felt that the absence of haustrations was of any importance whatever unless the colon was very much contracted and its lumen relatively small. Of

course, in such cases we are dealing with a pathological colonic wall, but in the wide open colon without haustrations, I believe if you watch such a case long enough or give the patient a barium meal subsequently, you will find a perfectly normal appearance. We must not go too far in the other direction, however, in overlooking some important lesion, as for instance a carcinoma or diverticulum. This is especially important in individuals in whom we have found evidences of irritability following the meal alone.

I know of one case recently examined in which such appearances were diagnosed as colitis when the patient really had a rather advanced carcinoma of the sigmoid, which should have been found by the barium enema, although it was not. Never in any of these cases of irritability should one be satisfied, therefore, to stop with the meal alone, but should always give the enema in order to be sure some organic lesion is not present as a basis for that upset in the nerve supply of the large bowel.

Appendicitis, of course, is one of the conditions which may be present but that is a disease which I have not diagnosed for many, many years by roentgenological means, because I do not believe it can be so diagnosed accurately. You can find adhesions involving the appendix, but the diagnosis of appendicitis is not a roentgenologic possibility, but more or less of a guess, though very often a fairly good one.

Dr. Leon T. LeWald, New York City. I wish also to emphasize what has been brought out, that this diagnosis of spastic colon and mucous colitis is usually a misnomer. I speak very feelingly on this matter, because I spent several years as pathologist in the Philippine Islands where I saw any number of cases of colitis of various types, and on my return from the Philippines, it happened that the diagnosis of "mucous colitis" and "spastic colon" was beginning to be made in patients who had none of the symptoms of true colitis. Instead of diarrhea or bloody stools, constipation was present.

This paper, I am sure, is going to set us right on this question.

Dr. Pancoast has said that the meal examination should be followed by the barium enema. I agree most heartily. Dr. Bargen particularly made the statement that the study of the colon by means of the enema was of more value than the meal examination. In my opinion, *neither one* of the two should be omitted in any complete examination of the colon.

I think in regard to the appendix, while, as Dr. Pancoast has stated, it may have been overdiagnosed at times, an omission to make a roentgen examination in a supposed case of chronic appendicitis may lead to serious error. I know of two cases recently in which the failure to locate the appendix prior to operation led to very serious, prolonged surgical operation. In one case the appendix was found up under the liver, resulting in a very serious abdominal hernia which could not afterwards be repaired, and the other was a case of transposition which led the surgeon to make a very long incision in a child for which there was no necessity had previous roentgen examination been made. A roentgen examination should always be made prior to operation for supposed *chronic appendicitis*.

URINARY TRACT ROENTGENOGRAPHY BY MEANS OF SKIODAN

A PRELIMINARY REPORT

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THE visualization of the urinary tract following intravenous administration of a contrast substance has long been a research problem. The introduction of uroselectan and more recently of skiodan (metufan or abrodil) has definitely made this a clinical problem. Such advance was accomplished only after painstaking study of other methods. Osborne, Sutherland, Scholl and Rowntree[17] in 1923 reported the production of pyelograms following the intravenous administration of sodium iodide. They also attempted parenteral administration but found that by this method the bladder alone was visualized. The intravenous method was only partially successful. An intensification of the renal shadow was noted, but pyelograms were obtained in only 50 per cent of the cases. Hryntschak and Volkmann,[10] Rosenstein and von Lichtenberg,[19] Lenarduzzi and Pecco[15] attempted the use of this and other measures, with variable success. Roseno[18] was the first to inject large quantities of urea coupled with sodium iodide intravenously. This medium was also used by mouth. The reactions which so frequently accompany the use of this drug constituted a major objection to its general adoption, and the results obtained were not outstanding. Uroselectan, introduced in November, 1929, by von Lichtenberg and Swick,[16] was the most outstanding advance in this field. The continued use of uroselectan has stimulated additional work.

Bronner[4] of Köln, in April, 1930, made the first announcement of his work with a new substance called abrodil. A subsequent publication by Bronner, Hecht and Schüller,[5] gave a detailed account of extensive investigations which they had carried out. The drug has subsequently been introduced in this country as skiodan. Skiodan is a white crystalline powder, the sodium salt of iodomethane sulphonic acid, ICH_2SO_3Na. It was first manufactured by Ossenbeck and Tietze[3] at Leverkusen, Germany. This is a stable organic compound of iodine which will not react with nitric acid or silver nitrate and is absolutely unchanged by boiling sufficient for sterilization. The iodine content is 52 per cent; the chemical composition is such that it is not attacked in metabolic processes. It can be recovered from the kidneys or bladder in pure form; no inorganic iodine can be demonstrated. The general compatibility for intravenous injection is the same as that of equivalent amounts of sodium chloride. One hour after intravenous injection 47 per cent of the injected material can be recovered from the urine; in three hours 76 per cent, in nine hours 89 per cent, and in twenty-four hours, 93 per cent. The studies of Bronner, Hecht and Schüller revealed that after doses too large to be considered in man there were only slight reversible tubular changes, and no change was demonstrated in the glomeruli. They found that the theoretic maximum dose for a 60 kg. man was 120 grams. In their clinical studies they first used 40 grams, which produced occasional symptoms such as pounding in the head, hot flush, slight trembling, or malaise; 20 grams administered intravenously in 100 c.c. distilled water produced an equally good pyelogram and absolutely no symptoms were noted after injection. The local effect on the vein is slight. Bronner noted slight localized thrombophlebitis in one case out of a hundred. Small extravasations into the subcutaneous tissues produced burning pain for about ten minutes but there was no fur-

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ther effect. The urine was studied for two to three days after injection in a large series of cases but no definite urinary changes were found except in one case, in which a few erythrocytes were noted in a catheterized specimen.

The standard dose of skiodan for intravenous administration to adults is 20 grams dissolved in 100 c.c. of double distilled water. The solution may be sterilized by boiling. It should be injected at body temperature either by the syringe or gravity method. Injection should be as rapid as possible, for rapid administration produces no ill effects and excretion begins almost immediately. The first film should be taken five minutes, and the second fifteen minutes after injection. In many instances the first film most successfully delineates the renal pelvis and ureter; in others the second film better accomplishes this purpose. The visualization of the bladder is uniformly better on the second exposure. It has been our experience that exposures produced after a more prolonged interval are of no assistance. In almost every instance in which injection of 100 c.c. of solution has been accomplished without mishap in four to eight minutes, good visualization of the entire urinary tract has been obtained. In the absence of obstruction the density of the shadow is never so great as that obtained by retrograde pyelography; in the presence of obstruction it may be superior to the latter. The density, however, is greater than that obtained by any previous method and unless there is a large amount of gas in the overlying bowel the pyelogram is of diagnostic quality. Although a compression apparatus has been found by other investigators to produce somewhat superior visualization, its use is open to question and we have not found it sesential. If such compression has any actual effect upon the ureters it would necessarily interfere with their functional activity, and one of the major advantages of the method is that anatomical and functional information are obtained simultaneously.

Köhler[13] reports the successful rectal administration of skiodan (abrodil). We have not met with great success in this method. The density of the pyelogram is sometimes insufficient for diagnosis and the kidney area is often obscured by the solution which had been forced by reverse peristalsis as far as the hepatic flexure of the colon. The technique is as follows: Two hours after the patient has received a cleansing enema, the skiodan solution (30 grams in 50 c.c. of water with the addition of 15 drops of tincture of opium) is administered rectally. The patient remains seated for thirty minutes to minimize the tendency of the solution to flow into the proximal two-thirds of the colon. The exposure is then made in the horizontal position, and Köhler prefers the use of the compression bag.

The oral administration of contrast media was attempted by the original investigators.[16] Likewise Roseno[18] administered pyelognost, his urea sodium iodide mixture by this route, and uroselectan has been used in like manner. Köhler's experiment with skiodan demonstrated that this compound is absorbed but slowly from the stomach and small intestine. Its innocuous taste and its tolerance by the intestinal mucosa would otherwise suggest this method. Oral administration of such an opaque substance is fraught with the probability that the renal areas will be obscured by the presence of the dye in the stomach and small bowel.

Through the kindness of the Winthrop Chemical Company we obtained a small quantity of skiodan. Of 8 intravenous injections 7 were successful. The one failure was due to mechanical difficulties which prolonged the administration over a period of twenty minutes; the pyelograms were consequently too faint to rely upon for diagnosis. Two attempts at rectal injection met with failure to obtain roentgenograms of diagnostic quality. In several cases a 20 per cent solution has been injected as a medium for retrograde pyelography and the complete absence of irritation has been noteworthy.

The following are brief abstracts of the

histories of 4 cases in which intravenous injection of skiodan was performed:

Case I. H. C. S. 27224. White male, aged thirty-nine, single. Present complaint is burning urination and hematuria of two months' duration. Repeated catheterized urine specimens contained a faint trace of albumin and occasional erythrocytes, and tubercle bacilli were demonstrated. The erythrocyte count was 4,160,000; leucocytes, 8,900, and hemoglobin 83 per cent (Sahli). Three attempts to catheterize the left ureter were unsuccessful.

Roentgen examination after intravenous injection of skiodan showed an obliteration of the minor calyces on the right with widening of the major calyces and dilatation of the pelvis and ureter. An apparent constriction was noted in the ureter just proximal to the ureterovesical junction. The right kidney was increased in size. There was marked irregularity of all the calyces in the left kidney with cortical necrosis.

Diagnosis was made of renal tuberculosis of the left kidney and hydronephrosis of the right; the suggestion was made that tuberculosis of the right kidney and ureter be excluded. Left nephrectomy was subsequently performed and renal tuberculosis demonstrated. Figure 1*a* is the bilateral pyelogram obtained by this method. The retrograde right pyelogram is included for comparison (Fig. 1*b*).

Case II. M. P. 27589. White female, aged fifty-one, married. Present complaint is constant pain in the region of the bladder and frequent urination associated with occasional pain since an attack of influenza in March. Repeated urine specimens showed a trace of albumin, occasional erythrocytes and many leucocytes. Phenolsulphonphthalein excretion 45 per cent. The erythrocyte count was 4,210,000, leucocytes 7,200 and hemoglobin 65 per cent.

Preliminary film of the kidney, ureter and bladder area demonstrated gallstones, and a globular tumor with small areas of calcification, overlying the iliac crest. The left kidney shadow was somewhat enlarged but normal in position. Examination after administration of skiodan failed to reveal the right pelvis and ureter. On the left there was extreme dilatation of the calyces and some dilatation of the pelvis and ureter.

Diagnosis of left hydronephrosis and nonfunctioning right kidney, probably tuberculous, was made. Figure 2 is a reproduction of the film obtained fifteen minutes after injection.

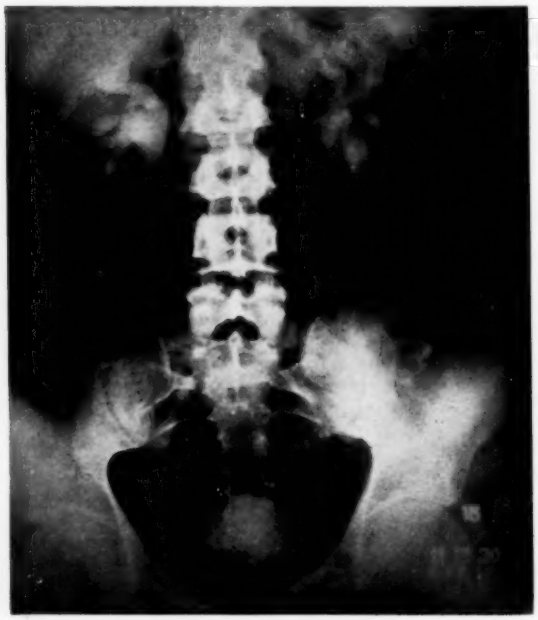

Fig. 1*a*. Case I. Roentgenogram taken fifteen minutes after injection of 100 c.c. 20 per cent solution of skiodan.

Fig. 1*b*. Case I. Retrograde pyelogram of the right kidney.

Unfortunately the right kidney shadow was not well visualized.

Case III. M. L. 28809. White female, aged thirty-three, married. Present complaint, pain in right flank. Appendectomy had been performed five years previously. Preliminary film of the kidney, ureter and bladder area, and examination of the gastrointestinal tract showed no evidence of pathology. To exclude a urinary tract lesion skiodan was injected intravenously. The resulting pyelogram demonstrated no evidence of pathology in the kidneys, ureters or bladder (Fig. 3).

Fig. 2. Case II. Hydronephrosis of the left kidney; non-functioning right kidney, probably tuberculous.

Fig. 3. Case III. Normal bilateral pyelogram taken after injection of skiodan.

Case IV. A. H. 27502. White male, aged fifty-two, married. Present complaint is intermittent hematuria of two years' duration; progressively more frequent and severe. Backache and pain over the bladder region. Numerous examinations of urine specimens showed a faint trace of albumin, occasional leucocytes and many erythrocytes. Phenolsulphonphthalein excretion was 68 per cent. The erythrocyte count was 5,120,000, leucocytes 11,500 and hemoglobin 105 per cent (Sahli). Roentgen examination after administration of skiodan demonstrated a normal left pyelogram, but on the right there was a constant deformity interpreted as the result of a hypernephroma (Fig. 4*a*). A retrograde pyelogram confirms the definitely persisting deformity of the calyces and pelvis of the right kidney (Fig. 4*b*). Right nephrectomy was performed and the diagnosis confirmed.

The indications for intravenous pyelography are most simply and comprehensively stated by von Lichtenberg and Swick:[16] (1) When cystoscopy and ureteral catheterization and direct pyelography cannot be performed because of anatomical, pathological or technical reasons. (2) When because of obstruction in the ureter the contrast substance cannot be injected beyond the block. (3) When direct pyelography cannot be undertaken without risk.

A rapidly increasing volume of literature testifies to the practicability of the method. One can readily agree with Beer[1] that "the field for intravenous pyelography is much larger than the field for ordinary pyelography;" that "periodic health controls of

Fig. 4*a*. Case iv. Roentgenogram taken five minutes after intravenous injection of skiodan; hypernephroma of the right kidney.

Fig. 4*b*. Case iv. Retrograde pyelogram of the right kidney.

the kidney, ureter and bladder will be simplified." It must not be conceived, however, that intravenous pyelography can completely supplant the older direct method. As Kretschmer[14] states: "It is still necessary before surgical procedures are carried out on the kidney to examine the patient with the cystoscope, to catheterize the ureter; to carry out the usual careful examinations to determine the presence of pus and blood, to make bacteriological studies for infection, and to ascertain the differential function of the kidneys." And this applies likewise to pathological conditions of questionable nature which require medical management. Certain it is that even greater care must be exercised in the interpretation of the films obtained then in the case of retrograde pyelograms, inasmuch as the density of the image is usually less.

REFERENCES

1. Beer, E. Uroselectan as an intravenous pyelograph, ureterograph and cystograph medium (Swick). *S. Clin. North America*, 1930, *10*, 441–450.
2. Berry, N. E. Pyelography following intravenous injections. *Canad. M. Ass. J.*, 1930, *22*, 546.
3. Braasch, W. F. Intravenous pyelography. (Editorial.) *Surg. Gynec. & Obst.*, 1930, *51*, 421–423.
4. Bronner, H. Aussprache über Pyelographie. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1930, *42*, *Kongressheft*, 20–21.
5. Bronner, H., Hecht, G., and Schüller, J. Ausscheidungspyelographie mit Abrodil. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1930, *42*, 206–208.
6. Chwalla, R. Our recent experiences with intravenous pyelography. *Brit. J. Urol.*, 1930, *2*, 256–267.
7. Hartman, G. W. Uroselectan; reactions accompanying its practical application. *Calif. & West. Med.*, 1930, *33*, 867–872.
8. Heritage, K. Intravenous pyelography as a test of renal function. *Lancet*, 1930, *2*, 132.
9. Heritage, K., and Ward, R. O. Excretion urography; preliminary note on new method of radiological demonstration of urinary tract. *Brit. M. J.*, 1930, *1*, 734–737.
10. Hryntschak, T., and Volkmann, J. Cited by Heritage and Ward.
11. Hyman, A. Intravenous urography in the diagnosis of urological diseases in childhood. *Surg., Gynec. & Obst.*, 1930, *51*, 409–415.

12. Kidd, F. Intravenous pyelography. *Lancet*, 1930, *2*, 128–132.
13. Köhler, H. Die Ausscheidungspyelographie mittels Uroselectan. *Deutsche med. Wchnschr.*, 1930, *56*, 1775–1776.
14. Kretschmer, H. L. Intravenous urography. *Surg., Gynec. & Obst.*, 1930, *51*, 404–408.
15. Lenarduzzi, G., and Pecco, R. Iniezioni endovenose di ioduro di sodio (richerche radiol sperimentali). *Arch. di radiol.*, 1927, *3*, 1055–1060.
16. von Lichtenberg, A., and Swick, M. Klinische Prüfung des Uroselectans. *Klin. Wchnschr.* 1929, *8*, 2089–2091.
17. Osborne, E. D., Sutherland, C. G., Scholl, A. J., and Rowntree, L. G. Roentgenography of the urinary tract during excretion of sodium iodide. *J. Am. M. Ass.*, 1923, *80*, 368–373.
18. Roseno, A. Die intravenöse Pyelographie. II. Mitteilung. *Klin. Wchnschr.*, 1929, *8*, 1165–1170.
19. Rosenstein and von Lichtenberg. Cited by Roseno.
20. Roth, E. J. H., and Wright, H. W. S. Intravenous pyelography. *Brit. M. J.*, 1930, *1*, 778–780.
21. Schumacher, P. Intravenöse Pyelographie bei Frauen in und auserhalb der Gravidität. *Zentralbl. f. Gynäk.*, 1930, *54*, 1474–1483.
22. Swick, M. Intravenous urography by means of uroselectan. *Am. J. Surg.*, 1930, *8*, 405–414.
23. Wolbarst, A. L., and Hirsch, I. S. Intravenous urography. *Med. J. & Rec.*, 1930, *132*, 1–6.

CONGENITAL IDIOPATHIC ENLARGEMENT OF THE HEART*

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ENLARGEMENT of the heart in infancy and childhood which cannot be explained on a pathologic basis is a rare condition, but as sudden death frequently follows any unusual strain upon the heart in these cases, and as both the symptoms and the roentgen findings may resemble closely those seen with enlargement of the thymus gland, they should be of special interest to roentgenologists.

Stoloff, in 1928, reviewed the literature and found reports on 34 cases, only 17 of which he was willing to accept as true cases of idiopathic enlargement.

In most of the cases reported, the size of the heart was enormous—three or four times that of the normal. The average duration of life was fourteen months; frequently the terminal illness occurred at about the time the child began trying to walk or was preceded by an attack of whooping cough. In several cases there was an associated enlargement of the thymus gland. Dyspnea, cyanosis, or both, were present at some time in almost every case. The physical examination usually showed enlargement of the heart and occasionally a systolic murmur was heard. Bulging of the left thoracic wall over the heart in very young children seems to be a diagnostic sign of some value. The roentgenograms which accompany some of the reports show a very much enlarged cardiac shadow although at times it is difficult to distinguish the outline of the left upper border.

Case I.† A female infant of seven months was admitted to the hospital with the following history obtained from the mother. The baby was full term, and considered normal until six months old, when she began to have spells of rapid breathing and cyanosis. She was brought to the Out-Patient Department of this hospital, where a tentative diagnosis of thyroid hypofunction was made, and small doses of thyroid extract were given. A month later, because of increasing symptoms, she was brought to the clinic and admitted to the hospital.

Physical examination showed an underdeveloped, undernourished, and moderately dehydrated infant breathing through the mouth. The tongue was large and partially protruding. There was a prominence of the chest anteriorly, with dullness and diminished breath sounds over the left front. The heart was enlarged to the left, and at the apex there was a blowing systolic murmur. The blood pressure was 85 mm. systolic, and 70 mm. diastolic. The remainder of the physical examination was negative. The temperature was normal and the respirations were 35 per minute. The laboratory data were essentially normal except for a leucocyte count of 16,000.

At the end of the second day, the patient became obviously worse; there was marked cyanosis, and the temperature rose to 102°F. There was an accompanying rise in the pulse rate and respiration. The picture was that of an acute pulmonary infection.

Roentgen examination made on the day of admission showed the left side of the chest to be dull, except for a small area at the level of the diaphragm. The dullness was of even density throughout, and the outline of the heart was not visible through it. The outline of the right side of the heart could be seen, and was about normal in shape and position. The trachea was not displaced (Fig. 1). In the lateral view, the clear space behind the heart was present, and there was no evidence of compression of the trachea. There was absence of respiratory movements of the diaphragm on the left, and limited movements on the right. The right lung field was of normal size and brilliancy. It was thought that such an appearance could be due to extreme dilatation of the left auricle filling the thoracic space on this side, or to a

* Read at the Thirty-first Annual Meeting, American Roentgen Ray Society, West Baden, Ind., Sept. 23–26, 1930.
† Reported by Dr. H. B. Sprague and others at the meeting of the International Society of Medical Museums in New York.

complete absence of air in the left upper lobe. The absence of retraction of the chest wall and of displacement of the heart made massive collapse improbable, and the fact that the dullness extended into the extreme apex, and did not obliterate the clear space behind the heart was rather against a dilated auricle.

A consultant saw the child four days after admission and made the following note: "This is a very confusing picture, especially if one is to assume that no pathology was demonstrable a month ago. If congenital heart disease is present, it is impossible to diagnose the type. Congenital hypertrophy might have been missed at the previous examination, but the roentgenograms show a clear retrocardiac space and no enlargement to the right. This is much against auricular enlargement. The trachea is displaced to the right, the precordium bulging, and the left anterior chest is flat. Tumor with mediastinal compression, collapse of the upper lobe, and pulmonary infection seem a possible syndrome. Electrocardiogram might give a clue. I see no indication for cardiac therapy. I find no pericarditis."

The electrocardiogram was negative except for sino-auricular tachycardia, rate 140. After study of the roentgenograms, a consultant made the following note: "It is probable that the cardiac enlargement was present at the time of the first visit to the Out-Patient Department. The position and force of the apex impulse and the bulging of the bony chest wall on the left side, suggest the diagnosis of congenital idiopathic hypertrophy of the heart, now complicated by serious acute pulmonary infection."

At necropsy, performed fourteen hours post mortem, the following positive findings were obtained. The thymus was smaller than normal. The mesenteric glands were somewhat larger than normal. There was a small amount of pus in both pleural cavities, and the lungs showed consolidation of the lower lobe of the right, and of the entire lower lobe and inferior portion of the upper lobe of the left.

The heart weighed 175 grams (normal—34 grams). It was markedly dilated, dark red in color and occupied about one-third of the thoracic cavity. The coronary arteries showed no abnormalities. The wall of the right ventricle measured 6 mm. in thickness and the left 17 mm. All of the cavities were larger than normal. The circumferences of the valves were: mitral 5 cm., aortic 3.5 cm., tricuspid 5 cm., and pulmonary 3 cm. They were all negative. The aorta was normal and the kidney showed no abnormalities.

The microscopic examination of the tissues was as follows: The lungs showed almost complete atelectasis in the uninvolved as well as in the pneumonic portions. The liver showed marked diffuse vacuolization of hepatic cells. The spleen showed well-marked hyperplasia of the malpighian corpuscles. The kidneys, pancreas, adrenals and aorta were negative.

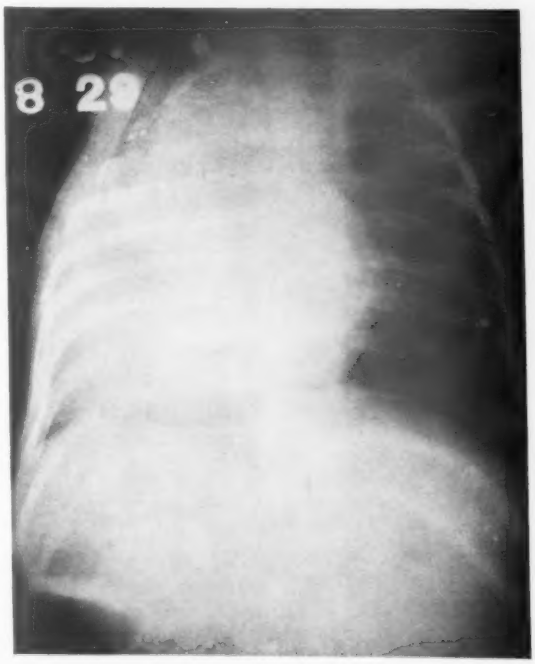

Fig. 1. Case 1. The left side of the chest is dull except for a small area just above the diaphragm. In the upper part the dullness is caused by the collapsed lung, in the lower by the greatly enlarged heart.

Heart: The muscle cells appear approximately twice as large, both in diameter and in length, as the cells in control specimens from children about six months of age, and about one-half as large as cells from an adult heart. A large vacuole surrounding the nucleus and running well up to either pole was found in each cell. A fat stain on formalin-fixed tissue shows no evidence of intracellular lipoid deposits. On the edges of the cells, well-defined myoglia fibers and sharply marked cross striations were made out.

Diagnosis: Idiopathic hypertrophy of the heart, bronchopneumonia, and atelectasis of the lung.

Case II. A baby, fourteen days old, entered the hospital with a history of cyanosis and dyspnea which appeared twenty-four hours after birth. He had had a roentgen examination which was said to show an enlarged thymus. Following this he was given two roentgen treatments with a portable machine. This was said to have relieved the symptoms. They recurred, however, and he was taken to the office of a local radiologist who treated him for enlarged thymus. He was then removed to this hospital.

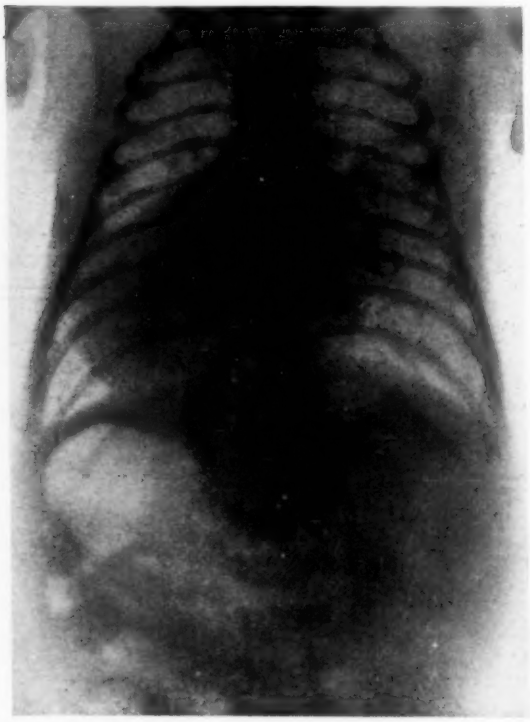

Fig. 2. Case II. The heart shadow is greatly enlarged to the left. The lungs appear normal.

At the time of admission, he showed considerable cyanosis and dyspnea, a few fine rales in the axilla, and the heart apex was 1 cm. outside the nipple line; there were no thrills or murmurs, and no demonstrable enlargement. The examination was otherwise negative.

The roentgen examination was as follows: There is no evidence of enlarged thymus. The heart shadow is definitely increased in size and prominent to the left. The curve of the right auricle is high. The blood vessel markings of the lung are prominent. The supracardiac shadow is smaller than usual; this may be due to an anomaly in the great vessels. The changes in the heart are consistent with congenital heart disease (Fig. 2). The patient grew rapidly worse and died a few hours after entering the hospital.

At necropsy, the abnormal findings were confined to the heart and right lung. The lower half of the right lung was atelectatic, but otherwise negative. The heart weighed 50 grams and was very much enlarged, occupying about one-fourth of the thoracic cavity. All of the cavities were dilated to an equal degree. The walls were slightly thickened, measuring 5 mm. on the right and 6 mm. on the left. There was a patent ductus arteriosus which allowed the passage of a large probe. The valves and great vessels were normal. The liver was slightly enlarged.

A histological study of the heart muscle was not made.

The cause of idiopathic enlargement of the heart is unknown. It has been found at birth. The diagnosis is usually made at necropsy, although in one of our cases Dr. White was able to make a correct clinical diagnosis. The patient is likely to be referred to the roentgenologist with a diagnosis of suspected thymic enlargement. If his findings are the same as in Case II of this report, he will probably make a diagnosis of enlarged heart without evidence of enlargement of the thymus and will be somewhat disturbed when informed later that the child died suddenly from a cause which could not be fully explained. Should his findings be those reported in Case I, he may mistake the shadow cast by the enlarged auricle and collapsed upper lobe for that of the thymus or of a thymic tumor; and should he advise a course of roentgen treatments, there is no reason to believe that the condition of the patient will be improved, and there is a considerable chance that the death of the patient will be attributed to his efforts.

So far as is known, the disease is always fatal; but as diagnosis is extremely difficult in the living, it is quite possible that re-

covery does take place. It is also possible that the disease is more common than generally supposed, since no cases without necropsy findings are reported.

The clinical and roentgen findings upon which the presence of idiopathic enlargement should be suspected are: rapid breathing with or without cyanosis, bulging of the chest wall over the cardiac area, enlargement of the heart to percussion, and a soft systolic murmur heard at the apex. The roentgen examination should show a very much enlarged cardiac shadow, the increase being to the left in the region of the ventricles, the shadow of the great vessels remaining normal. In some cases, however, there is enlargement of the auricles with collapse of part of the left lung, producing a shadow of homogeneous density throughout the greater part of the left lung field without displacement of the heart or trachea.

REFERENCES

1. Emerson, P. W., and Green, Hyman. Read before the American Heart Association, Minneapolis, June 12, 1928. Abstract *J. Am. M. Ass.*
2. Miles, R. S. Congenitally enlarged heart. *Am. J. Dis. Child.*, 1928, *36*, 867.
3. Stoloff, E. G. Socalled idiopathic enlargement of heart in infancy and in childhood. *Am. J. Dis. Child.*, 1928, *36*, 1204–1217.

DISCUSSION

Dr. A. W. Crane, Kalamazoo, Mich. I will have to acknowledge that I have had no personal experience with the congenitally enlarged heart in this respect. I judge I am no worse off than the rest of you. We doubtless have come across them without recognizing them, and from now on when we take plates of children, new-born, with the expectation of finding an enlarged thymus, we may recognize the enlarged heart. The fact that so many children shortly after birth are now x-rayed for this purpose makes it altogether probable that before another meeting of the Society, there will be a much larger experience with the congenitally enlarged heart. The facts as set forth by Dr. Holmes emphasize the necessity of care in the interpretation of the anteroposterior plates for the diagnosis of enlarged thymus. The importance of the lateral view, as emphasized by Dr. Pancoast and others, is here brought out in striking relief. It is probable that the lateral view should be considered necessary before the diagnosis of enlarged thymus is made. It often happens that the roentgenologist is called upon to treat a case of enlarged thymus by the physician and he may be tempted to give the treatments without having established a diagnosis himself. I am quite sure from personal experience that we are under obligation to make the diagnosis ourselves before we enter upon treatment.

I had a disagreeable experience or two where the case had not been benefited and where the parents wanted to know why a treatment should be given for something which the child didn't have. We might have an explanation, but no real defense for such a procedure. Apparently the finding of an enlarged heart is very important in a prognosis. These cases where the heart is sufficiently large are, as I understand it from Dr. Holmes' paper, almost 100 per cent fatal. Some of the cases might be considered as congenitally enlarged. If we were to estimate the size of the heart by some such method as Bardeen gave us for the estimation of adult hearts, we might be able to make a diagnosis and possibly there might be some treatment which would carry some of the infants through to adult life. How desirable that would be, of course, I don't know. Anyway, this paper of Dr. Holmes is a very distinct contribution to roentgenology, and I am sure will make us all cautious about the diagnosis of enlarged thymus.

CHRONIC HYPERPLASTIC TUBERCULOSIS OF THE COLON

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TUBERCULOSIS of the intestines is manifested pathologically in several forms that have been variously segregated. Most convenient is that classification quoted from Dowdle[4] which makes four divisions:

1. Ulcerating type.
2. Cicatricial or stenosing type from healing or annular ulceration of the bowel.
3. Entero-peritoneal type—an ulcerating, caseating lesion of the ileocecal segment, with marked tendency to softening and suppuration. In this type, external fistulae are common.
4. Chronic hyperplastic type.

Of these, the hyperplastic tuberculosis of the colon is the least common and least known. It was described by Hartman and Pilliet in 1891. It is often a primary tuberculous lesion without evidence of lesion elsewhere. Mummery,[8] in 1923, collected 80 cases from his own experience, of which 47 were males, 33 females. He quotes Bernay as having collected 71 cases and Conrath 77 cases from the literature with a similar division for the sexes. It usually occurs in the middle period of life although Branch[2] reported 8 cases with the average age incidence being between twenty and thirty. The condition is generally localized to one portion of the colon, although more rarely there are two or three distinct lesions. Rarely, the whole or a large part of the colon is affected, the so-called "gas-pipe colon."

Chronic hyperplastic tuberculosis of the colon most often occurs in the cecum and lower portion of the ascending colon. Thus in 100 cases, Mummery states, 48 were in the cecum, 39 in the cecum and ascending colon, 6 in the sigmoid flexure, 4 in the whole colon, 3 in the cecum, ascending and transverse colons. Kaufmann also notes its occurrence in the splenic flexure. As has been stated, the disease is often primary, in only 24 of 100 cases was there tuberculosis elsewhere, divided as follows: lungs 18, tuberculous peritonits 1, tibia 1, genitourinary tract 2, phalanges 1, vagina 1 (Mummery).

Grossly, there is tumor formation accompanied by stricture of the bowel lumen. The disease is essentially chronic, the inflammation encouraging the formation of fibrous tissue or thickening rather than caseation or ulceration; often the mucous membrane is intact. At operation, the tumor is very hard and densely indurated. The peritoneum is normal, or small fine tubercles may be made out. When the mass is cut, the walls of the bowel are seen greatly thickened and feel like cartilage. The cut section is bluish-gray and translucent; it is glistening. This is the stenosing, hyperplastic cicatricial tuberculosis which may be mistaken for a neoplasm. Other forms are like fungi, others resemble diffuse infiltrating and stenosing carcinomata. In still other cases, the mucosa is papillary at or near the narrow area from connective tissue proliferations or villous polypoid mucosal remains. This according to Kaufmann, who gives an extensive bibliography of the pathological literature, is the most frequent form. Typical tuberculous ulcers may be alongside. In the majority of cases quite analogous to the tuberculous stenoses of the small intestines, the changes are characterized by marked connective tissue proliferations with tubercles and ulcers in various stages of disintegration or healing. Kaufmann has observed that the characteristic tuberculous changes may be confined histologically to a few nodules. There are also exceptional cases in which the hyperplastic cicatricial tubercu-

losis involves large areas of the colon without causing noteworthy stenosis, thus resembling old ulcerations of dysentery. Richter[13] believes it probable that a nonspecific chronic ulcerative inflammation of the submucosa with abscesses, fistulae and scar tissue, is the chief cause in such cases, while the tuberculosis is more in the nature of an accidental infection. That chronic, nonspecific, infectious granuloma of the colon can resemble very closely chronic hyperplastic tuberculosis, clinically, roentgenologically and pathologically has been reported,[9,16] and is shown very well by material from this Hospital.[5] Sometimes, stenosis is caused by cicatricial contraction from without as, for instance, from granulation tissue on the outside of an old ulcer.

The roentgen appearance of the hyperplastic type of tuberculosis, as it particularly occurs in the cecum and ascending colon, has been well described. Thus Carman[3] describes the signs as follows: A filling defect, due to the ravages of the disease, with spastic manifestations. Under pressure of a barium enema, the cecum and ascending colon are seen to fill irregularly and are decidedly narrowed in their transverse diameter. The normal haustral markings are absent and Bauhin's valve is usually incompetent. After the pressure of the enema is relieved by shutting off the flow, the involved area usually empties and remains empty while the remainder of the colon may retain the enema for some time. The other two signs are spastic phenomena and obstruction. The triad, however, are not characteristic since they are seen in ulcerative carcinoma of the cecum and chronic ulcerative colitis. Assmann[1] also insists that the etiological diagnosis of colitides should be based on sound clinical and bacteriologic studies; the roentgen appearance is not sufficient for a differential diagnosis. Neither Carman nor Assmann illustrates this type of lesion anywhere but in the cecum and ascending colon, although both call attention to the fact that it can take place more rarely in the middle and distal portions of the colon. The general subject of tuberculosis of the colon is further well discussed roentgenologically by Schlesinger[14] and Stierlin.[15] Dowdle reports a case involving the descending colon —the roentgen diagnosis was neoplasm. There have been several careful reports with roentgenograms of involvement of the cecum and ascending colon as, for example, those of Branch,[2] Ratti,[11] Rankin,[10] Jones,[6] Rieder.[12]

The following 3 cases are reported: first, because their location and type are quite uncommon; secondly, to recall to roentgenologists the characteristics of chronic hyperplastic tuberculosis, and thirdly, to emphasize the danger of attempting an etiologic diagnosis of stenosing lesions of the colon from the roentgen appearance alone.

CASE REPORTS

Case 1. J. C., an Italian housewife, aged thirty-one, was admitted to the service of Dr. Kessel on August 21, 1930, and discharged on October 2, 1930. She gave a history that during the year previous to admission she had perium-

Fig. 1. Case 1. Appearance of the colon six hours after the barium meal. Arrow points to the annular lesion. Note that the cecum is irregularly filled.

bilical cramps lasting about five minutes, not very severe, usually occurring immediately after meals and not radiating. Six months prior to admission there was an onset of diarrhea, five to ten loose stools a day, containing mucus and occasionally blood. She had vomited a few times, her appetite was poor, there was loss of weight and strength with increasing pallor; there was no fever nor chills. For the past three months there had been slight but persistent unproductive cough and diffuse night sweats. There had been an amenorrhea for three months.

Examination showed a markedly pale woman with prominent abdominal veins and club fingers. The abdomen had a doughy feel; there was a smooth elongated mass in the right lower quadrant, tender to pressure, and an irregular sense of resistance in the right upper quadrant which was not tender. Blood pressure, 102/68; hemoglobin, 70 per cent; red blood count, 3,200,000; white blood count, 4000; polymorphonuclears, 65 per cent; lymphocytes, 25 per cent; mononuclears, 9 per cent; Wassermann reaction, negative; blood urea and sugar, normal. The stool was negative microscopically; it was alternately positive and negative to guaiac. Sigmoidoscopy to 24 cm. was negative. The patient suffered a febrile course while in the hospital, the temperature ranging irregularly from 99° to 102.5° F., pulse, 90 to 120, respirations 20.

FIG. 2. Case I. Appearance of the colon during the barium enema examination. The arrow points to the lesion. Note that the cecum is completely and regularly filled. There was spasm of the descending colon, roentgenoscopically.

FIG. 3. Case II. Appearance of the colon during the barium enema examination. Arrow points to the lesion.

Roentgen examinations on August 23 and September 2, 1930, by barium meal and enema showed areas of constriction and marked spasm of the rectosigmoid and descending colon. In the hepatic flexure there was constantly present an area of constriction about 2 inches in length and 1/4 inch in width, with irregular borders. This constriction was noted on the six hour roentgenogram in the presence of an irregularly filled cecum. Deformity of the third portion of the duodenum was noted and the picture was thought to be that of a neoplasm with adhesions to the duodenum.

On September 12, 1930, an exploratory laparotomy was performed. There was a very small amount of free fluid in the pelvis. The

Fig. 4. Case II. Appearance of the colon after defecation. Arrows point to sites of the annular lesions found at operation.

parietal peritoneum was normal. The terminal ileum and numerous scattered areas in the rest of the ileum showed serosal tuberculous involvement with thickening of the underlying bowel wall. The ileocecal valve appeared narrow. Examination of the colon showed a small area involving the hepatic flexure measuring about 3 cm. in length. Fingers could be introduced through the annular lesion at this site without difficulty. A similar area was found in the sigmoid colon. A specimen of the serosa of the ileum was removed for microscopic examination. The pathological report was tuberculosis.

It is interesting to note that this patient had pulmonary tuberculosis (by physical and roentgen examinations) which, incidentally, was considerably activated by the exploratory laparotomy under spinal anesthesia.

Case II. Mrs. E. P., aged thirty-six, was admitted to the hospital on April 22, 1930. She stated that seven years previously she had discovered that she had pulmonary tuberculosis. Several other members of her immediate family were similarly afflicted. For the past three years she had complained of diarrhea, loss of weight, pallor and slight abdominal pain.

Roentgen examination of the colon with the aid of a barium enema showed the following: With the introduction of the barium mixture the colon filled very readily to a point corresponding to the junction of the proximal and middle thirds of the transverse portion where there was a slight delay and the colon in this area was narrowed. Another point of delay was at the hepatic flexure. The cecum failed to visualize properly, only a small portion of the barium being seen there. The roentgenograms show three distinct filling defects: one at the junction of the proximal and middle thirds of the transverse colon, one at the hepatic flexure and one involving the cecum. Examination of the chest showed a bilateral tuberculosis involving both lungs from the apex to the eighth rib posteriorly. Most of the infiltrations appear fibrotic, though there are some that appear recent.

On April 26, 1930, an exploratory laparotomy was performed by Dr. Berg, and multiple ulcers and tubercles were noted on the serosa of the large and small bowel. The cecum and ascending colon showed a large infiltrating indurated mass, with ring-like groups of miliary tubercles scattered throughout the entire large and small

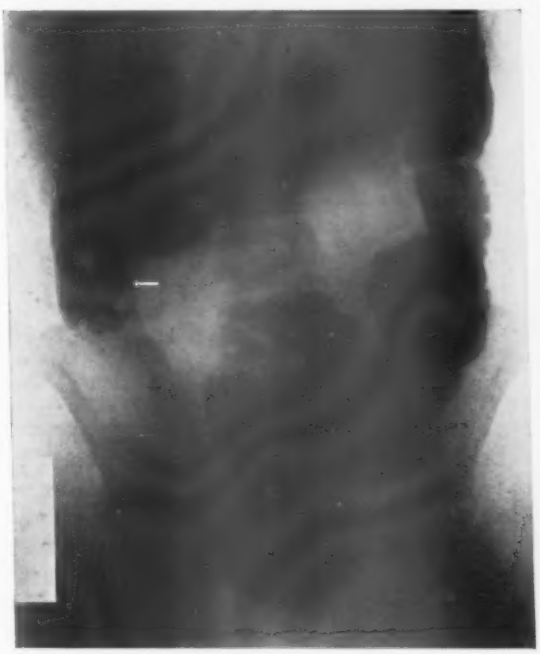

Fig. 5. Case III. Examination by the barium enema, January 22, 1929, showed filling defect in the cecum as indicated by arrow. Barium meal examination was negative.

bowel. The pathological report was tuberculosis.

Case III. E. S., a boy aged seventeen, was first admitted on January 20, 1929, complaining of symptoms of one year duration. The symptoms were belching, periumbilical pain, some red blood in the stools and diarrhea with three or four stools a day. A gastrointestinal examination at the onset, the details of which are not available, was reported colitis. On examination an indefinite mass was found on the right side in the region of the cecum. A roentgen examination of the chest was negative, and a barium meal examination on January 22, 1929, was said to be negative. A barium enema, however, showed a spastic ascending colon which, even though it filled, seemed to be somewhat irregular. An intradermal tuberculin test was positive to 1/50 mg. Old Tuberculin. The patient was not operated on but was placed on hygienic measures and ultraviolet light therapy.

The patient was readmitted to the hospital in September, 1930, still complaining of the symptoms previously present. A barium meal examination showed the following: Both at the three and six hour examinations, the terminal ileum for about a distance of 8 inches was narrow and cord-like in appearance. Hardly any barium was in the cecum but a small quantity was seen at the hepatic flexure to the proximal third of the tranverse portion. A barium enema examination showed delay to the passage of the barium at the proximal third of the transverse colon. The colon proximal to this point for a distance of about 4½ inches showed a narrow, iregular filling defect. The remainder of the proximal colon was completely filled with barium. Operation has not been performed.

Fig. 6. Case III. Roentgenogram taken six hours after barium meal, August, 1930. Arrows point to the cord-like terminal ileum. Note the irregularly filled, spastic cecum and proximal transverse colon.

Fig. 7. Case III. Roentgenogram taken during examination by the barium enema shows annular constriction in the proximal transverse colon (arrow).

COMMENT

The 3 cases herein summarized show the necessity for conservatism in statements as to the etiological agent in any given case of irregular annular constriction of the large bowel, regardless of its location. There is further emphasized the fact that hyperplas-

tic tuberculosis of the colon may be present without evidence of tuberculosis elsewhere, that there may not even be the ordinarily accepted criteria of intestinal tuberculosis. Stierlin's sign may not be present even in such an extensive process as was found in Case 1. The early or even moderately advanced process may only be manifested roentgenologically by spasticity.

The third case presented is only presumptively tuberculosis since no exploratory operation was performed. It must be remembered, however, that a similar appearance may be present in chronic nonspecific infectious granuloma of the intestines as has already been noted. The fact, however, that the terminal ileum in this case appears to be extensively involved is in favor of tuberculosis. In view of the material at this Hospital, however, the diagnosis in some of the reported cases of hyperplastic tuberculosis in the literature may be questioned, since in not all of them is it certain that an adequate pathological examination was made and properly interpreted. For this reason one might be rather hesitant about accepting the low incidence of pulmonary tuberculosis reported in association with hyperplastic tuberculosis of the colon in the figures quoted above.

SUMMARY

1. The literature on chronic hyperplastic tuberculosis of the colon is reviewed.

2. Three cases of the disease are presented, 2 of which were proved at operation.

3. The danger of making etiologic diagnoses of stenosing lesions of the colon is emphasized.

4. In the early manifestations of even hyperplastic tuberculosis spasticity may be the roentgenologic finding.

REFERENCES

1. Assmann, H. Die klinische Röntgendiagnostik der Inneren Erkrankungen. F. C. W. Vogel, Leipzig, 1928.
2. Branch, J. R. B. Intestinal tuberculosis causing obstruction. *Arch. Surg.*, 1928, *17*, 440–458.
3. Carman, R. D. Roentgen Diagnosis of Diseases of the Alimentary Tract. W. B. Saunders, Philadelphia, 1921.
4. Dowdle, E. Tuberculoma of the descending colon; chronic hyperplastic tuberculosis. *Ann. Surg.*, 1930, *91*, 786–789.
5. Ginzburg, L., and Oppenheimer, G. Cases of chronic non-specific infectious granuloma of the colon. To be published.
6. Jones, R. P. Röntgen ray in the diagnosis of intestinal tuberculosis. *U. S. Vet. Bur. Med. Bull.*, 1929, *5*, 588–591.
7. Kaufmann, E. Pathology for Students and Practitioners. Translated by Stanley P. Reimann. P. Blakiston's Son & Co., Philadelphia, 1929.
8. Mummery, J. P. L. Diseases of the Rectum and Colon and their Surgical Treatment. Baillière, Tindall & Cox, London, 1923.
9. Payr, E. Ueber eine eigenthümliche Form chronischer Dickdarmstenose an der Flexura coli sinistra. *Arch. f. klin. Chir.*, 1905, *78*, 671–714.
10. Rankin, F. W. Surgery of the Colon, New York, 1926.
11. Ratti, A. Tuberculoma stenosante del tenne. *Radiol. med.*, 1927, *14*, 985–993.
12. Rieder, H. Zum roentgenologischen Nachweis von Darmstricturen. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1906, *10*, 207.
13. Richter. Quoted by Kaufmann, ref. 7.
14. Schlesinger-Rachwalsky. Röntgendiagnostik der Magen und Darmkrankheiten. Berlin, 1927.
15. Stierlin, E. Klinische Röntgendiagnose des Verdauungskanals. Berlin, 1928.
16. Wilensky, A. O., and Moschcowitz, E. Nonspecific granulomata of the intestine. *Am. J. M. Sc.*, 1923, *166*, 48–66.

IRREGULAR OSSIFICATION OF THE EXTREMITIES OF BOYS AND GIRLS

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IN examining a large roentgenographic series of the extremities of the so-called normal child, one is struck by the frequency and variety of irregularities of ossification. There is the incidence of proximal epiphyses for metacarpals and metatarsals concerning which there has been much speculation in many languages, the distal epiphysis for the first metacarpal, the multiplicity of centers for the separate bones of carpus and tarsus, the appearance of double centers for the heads of metatarsals, and the almost uniform raggedness of the epiphyses for the metatarsal and the first phalanx of the great toe. Age and sex difference in the frequency of these anomalies is the chief concern of this investigation.

Three groups of children from private schools in different parts of the country were studied. The City and Country School in New York combined with individuals from the Institute of Child Development at Columbia University and the Horace Mann School, the Merrill-Palmer School in Detroit, and the Child Welfare Research Station of the University of Iowa supplied roentgenograms of the hands of 367 boys and 350 girls from one to eight years of age.* From the New York group and Iowa, films of the foot were obtained for 86 boys and 91 girls below five years and six months old, the last age at which several types of irregularity are visible in the foot; in the hand, evidences persist much longer. The closely comparable economic environment of these groups is evidently a greater factor than differences in racial composition and geographic location during early childhood: for separate averages and variabilities calculated for the greater transverse diameters of epiphyses and diaphyses of radii and tibiae and the presence of tarsal and carpal centers for each of the three groups—New York, Detroit, and Iowa City—are interchangeable in the same age and sex classes; equal uniformity was found in measures of stature and weight.[9]

In labelling the material normal, the meaning is used in contrast to clinical. No cases of active rickets or other calcium disturbance are included and all children were in sufficiently good health to attend school regularly. Records of early rickets, its probable duration and intensity could not be collected with sufficient exactness to make possible subdivision of material on that basis. It is probably safe to assume that the irregularities of ossification here noted in hands and feet are typical of the middle class population of the United States. For the 119 roentgenograms of the feet of the New York children an additional check was secured through the courtesy of Dr. Joseph Buchman of the Hospital for Ruptured and Crippled and the Hospital for Joint Diseases. Dr. Buchman examined the series and found among the variations no condition definitely pathologic.

Deviations from the regular course of ossification in the extremities are of two types: (1) multiple centers for epiphyses in the normal position, and (2) extra epiphyses for the metacarpals and metatarsals at the proximal end of the diaphysis. Irregularities of both kinds are more common in the foot than in the hand; the hand shows practically nothing but the second type.

* The New York records are mainly from the study group of the Bureau of Educational Experiments, supplemented through the cooperation of Professor Arthur I. Gates and Dr. R. G. Freeman, Jr. of Teachers College. All other roentgenograms were examined by the writer in the laboratories of the various institutions which were generously opened for the investigation through the courtesy of Dr. George D. Stoddard of the Iowa Child Welfare Research Station and Dr. Charles A. Wilson of the Merrill-Palmer School, Detroit.

In all four groups of children, the incidence and percentage of anomalies is higher in boys than in girls. The following table, based on the New York children, the group most intensively studied, illustrates the general statement just made (Table I). Since the rate of ossification in foot and ankle is more rapid than in hand and wrist, traces of irregularities in the foot disappear in the majority of cases after five and a half years, while evidence of a distal epiphysis for the metatarsal of the pollex may still be seen at ten. In regular growth, this divergence in rate and its relation to sex difference appears in all such quantitative measures as diameter and number of the epiphyses at any age. From Table II, it can be seen that while the girls' averages for foot development are always in advance of the boys', the divergence is much less than in the hand. The variability as measured by the standard deviation is also conspicuously smaller for the same sex and somewhat closer to that of the opposite sex. These evidences of sex difference are true only of ossification of cartilage, not of growth in length and breadth of long bones. The length of the radius of males and females throughout the age period of one to eight years does not differ consistently or in any marked degree; the male bone is more robust than the female.

TABLE I

IRREGULARITIES OF ALL TYPES

	Individuals	Number with Irregularities	Per cent Irregularities
		HAND	
Boys	98	18	18
Girls	82	7	10
		FOOT	
Boys	63	36	57
Girls	56	19	34

As one might expect, the boys' lag in ossification of the extremities is accompanied

TABLE II

RATE OF OSSIFICATION IN HAND AND FOOT

Age (Years)	Radial Index* Mean	Radial Index* Standard Deviation	Tibial Index* Mean	Tibial Index* Standard Deviation
		BOYS		
2	47.41	17.70	68.60	9.31
3	60.61	11.56	78.77	5.78
4	70.19	11.64	84.53	4.68
5	76.13	10.30	87.38	6.75
		GIRLS		
2	56.42	10.90	70.29	5.85
3	68.16	9.65	85.24	6.31
4	79.01	8.81	90.18	3.63
5	86.28	7.11	91.96	3.56
	Carpal Centers		Tarsal Centers	
		BOYS		
2	2.72	0.72	5.50	1.37
3	3.30	1.02	6.38	1.13
4	3.47	1.35	6.39	1.06
5	4.25	1.41	7.00	0
		GIRLS		
2	2.86	0.83	6.00	1.04
3	3.79	1.29	6.86	0.47
4	5.05	1.50	7.00	0
5	6.28	0.90	7.00	0

$$*\text{Indices} = \frac{\text{Epiphysis (Maximum Transverse Diameter)}}{\text{Diaphysis (Maximum Transverse Diameter)}} \times 100$$

by greater evidence of temporary defects than the girls'. In general, male calcium deposition seems to be inferior as manifested by a slower rate under normal conditions and in greater susceptibility to tetany and rickets.[1,6]

For both sexes during the period of rapid ossification, extra centers or double epiphyses often appear. The condition is rare

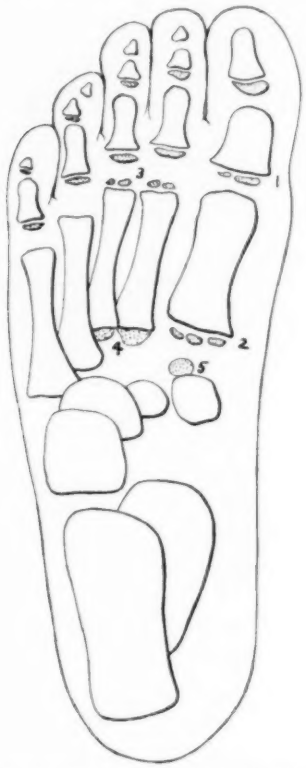

Fig. 1. Temporary irregularities in the ossification of the foot. Traced from the roentgenogram of a boy three years and two months of age. 1. Two centers for epiphysis of proximal phalanx of hallux. 2. Three centers for epiphysis of first metatarsal. 3. Two centers for distal epiphyses of second and third metatarsals. 4. Proximal centers uniting to diaphyses of second and third metatarsals. 5. Secondary center for internal cuneiform.

in the carpus, frequent in the tarsus and the heads of metatarsals and almost constant in two epiphyses of the hallux (Fig. 1). Only twice in 180 children were double centers noted in the carpus; in each case the bone was the semilunar and both individuals were girls.

The tarsal bones often ossifying from two or more centers are the internal cuneiform and the navicular; three cases of extra centers have also been noted for the external cuneiform and one for the middle cuneiform. Traces of the extra centers are visible from their first appearance in boys at two years until six or seven years of age; in girls they have been recorded from fifteen months to four years. The more rapid rate of female ossification obliterates irregularities at an earlier date (Table III).

The same is true of the double epiphyses for the metatarsal heads. The boys' roentgenograms display these from three through six years, the girls' from two through four. Two centers may appear for any metatarsal from the second to the fifth, the second, however, most rarely (Table IV).

While the phalanges, as a whole, ossify regularly from one center appearing in the midline of the shaft, a different history is characteristic of the great toe. The epiphyses of the metatarsal and proximal phalanx develop almost uniformly from two or three separate points, progressing from the outer edge of the shaft in the direction of the second toe. These isolated centers meet rapidly, forming a broken line for a short time, then smooth out and take on the form characteristic of the other phalangeal epiphyses. The epiphysis for the terminal phalanx is whole and centered (Fig. 1). Because of the rapidity of the process, it is difficult to estimate the exact incidence of this form of ossification from roentgenograms taken at six-month intervals and much of the observation is necessarily made on the children with a slower rate. However, the observations recorded in Table V indicate that these epiphyses develop in an extremely atypical manner. The percentages are considerably higher than for the other developmental irregularities of the foot. No evidence of sex differences in the actual occurrence of separate centers exists but as in the tarsal bones and the distal epiphyses of the metatarsals, the earlier appearance of points of ossification and the more rapid disappearance of anomalies greatly lessen the chances

to study female progress. On the basis of the roentgenograms available for this investigation, then, it is not possible to determine whether the female foot produces fewer of these irregularities because of better calcium regulation or whether by a more rapid rate of development, the defects are righted before, in many cases, they are observed.

The tendency for an individual foot to deviate from the normal in more than one spot is greater in males than in females (Table VI). Very few girls show more than one defective trait. Three types of irregularities were studied which leave evidence over a rather long period: separate centers for tarsal bones, double distal epiphyses for the metatarsals, and proximal epiphyses for metatarsals.

The phenomenon of extra epiphyses appearing at the end of the diaphysis which is opposite to their normal position has caused much comment among anatomists. French, German, Italian, British and Czech have all commented, explained, and appended extensive bibliographies. Almost all the studies are confined to the hand and are concerned with the distal epiphyses of the first metacarpal and the proximal epiphyses of the four other metacarpals. The epiphysis is most frequently joined to the diaphysis by a bridge of osseous tissue; in

TABLE III

EXTRA CENTERS FOR TARSUS

	Internal Cuneiform			Navicular		
	Cases	*Double Centers	Per cent	Cases	Double Centers	Per cent
Boys	50	19	38	44	5	11
Girls	44	3	7	43*	6	14

* ♂ 3 triple, 1 quadruple
♀ 1 triple

*1 triple

TABLE IV

TWO CENTERS FOR EPIPHYSES (DISTAL) OF METATARSALS

	II Metatarsal			III Metatarsal		
	Cases	2 centers	Per cent	Cases	2 centers	Per cent
Boys	41	5	12	34	15	44
Girls	38	4	10	33	9	27
	IV Metatarsal			V Metatarsal		
Boys	26	11	42	25	13	52
Girls	31	14	45	28	10	36

TABLE V

IRREGULAR EPIPHYSES OF HALLUX

	Metatarsal Double or Triple	Phalanx Broken line
Boys	63%	89%
Girls	69%	86%

TABLE VI

MULTIPLE IRREGULARITIES IN THE INDIVIDUAL FOOT

	3 types		2 types		1 type	
	No.	Per cent	No.	Per cent	No.	Per cent
Boys (34)	6	18	19	56	9	34
Girls (23)	3	13	4	17	16	70

other words, union is simultaneous with the beginning of ossification. More rarely, complete separation exists. In our series of 717 children, only one case of the second type was discovered (Fig. 2). The individual was a boy of three years, obviously retarded in the development of wrist and hand* (Table II). Two years later (Fig. 3) no union had been formed with the diaphysis of the second metacarpal of the left hand. The other proximal epiphyses are of the more usual kind.†

Fig. 2. Proximal epiphyses for first metacarpals entirely separate from the diaphyses. Extremely slow ossification clarifies the process. The subject is a boy three years of age. Averages for 105 three year old boys are: radial epiphysis, 11.3 mm.; number of carpals present, 3; number of epiphyses for metacarpals (distal) and phalanges, 16.

In addition, there is sometimes a distal epiphysis for the metacarpal of the thumb. This occurs in 7 per cent of the boys we have observed and in 2 per cent of the girls; for Prague school boys, 30 per cent is recorded.[2] The percentage distribution of proximal centers for metatarsals and metacarpals was so nearly uniform in the New York, Iowa, and Detroit groups that only the combined table is given here (Table VII). Again, the two features before stressed—greater incidence of irregularities in male than in female and in lower extremity than in upper—appear and in their most clear-cut form. The association of proximal epiphyses for the metatarsals with the same condition in the metacarpals occurs frequently. No coincidence was noted among the girls, but in 47 per cent of the New York boys having this irregularity of the foot, it was also visible in the hand.

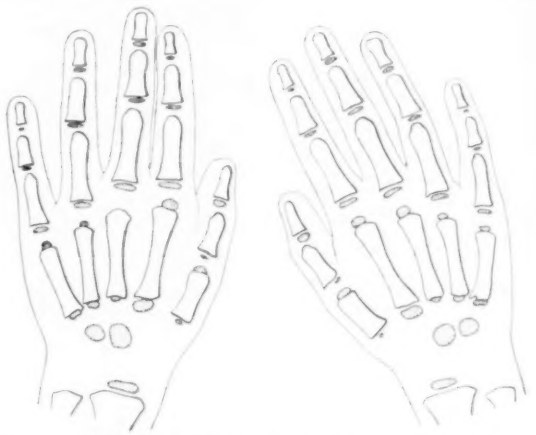

Fig. 3. Hands of the individual in Figure 2 at five years three months.

The opportunity to note the occurrence of proximal epiphyses in the hands of children of the same family was possible since there were within the City and Country School group, 11 families at least one member of which showed clear evidence of a proximal center for one or more of the

* Drawn from roentgenograms through the courtesy of the Merrill-Palmer School, Detroit.

† Compare Figure 1, metatarsals 2 and 3.

Table VII

Proximal epiphyses for metacarpals and metatarsals

Boys			Girls		
Cases	No. present	Per cent	Cases	No. present	Per cent
Metacarpals					
367	61	16.6	350	20	5.7
Metatarsals					
86	21	24.4	91	6	6.6

metacarpals. From the total of 27 siblings, 11 were subtracted to prevent overweighting, and the appearance of the trait among the brothers and sisters of a child who was known to possess it was then calculated and compared with the average of the general population (Table VIII). Since

TABLE VIII

PROXIMAL EPIPHYSES FOR METACARPALS IN SIBLINGS OF A CHILD WITH THIS ANOMALY

	Cases	No. present	Per cent
New York Families	16	4	25
From Table VII	717	81	11.3

obviously, the sex of the child eliminated from each family was an arbitrary matter, separate percentages for boys and girls could not be obtained. The brothers and sisters of a child with proximal epiphyses showed that character in 25 per cent of the cases, while the frequency among the general population was only 11.3 per cent. This higher relative incidence in these few families seemed to point to inheritance as a strong factor in the appearance of the anomaly.

Explanations of other writers are divided between phylogeny[3] and endocrinology[5]. The contrast between the neat, clear-cut epiphyses of the thumb and the dependence on the diaphysis which characterizes those of the great toe has been noted by Puyhaubert[4] and ascribed to the adaptation of the foot to the function of support. The possibility that strain during the early walking period, which coincides with the time of rapid ossification of those centers in which irregularities most frequently occur, might be a factor of considerable importance in explaining the higher incidence of anomalies in the foot than in the hand, seems worthy of consideration and research.

SUMMARY

Irregularities in the ossification of the extremities appear frequently on the roentgenograms of the so-called normal child. They are of two types, supernumerary centers and double epiphyses, and proximal epiphyses where only distal epiphyses are expected. Both kinds are more common in the foot than in the hand but disappear there more quickly because of a more rapid rate of ossification. The incidence is higher in males than in females, and union and disappearance are slower; this is in accord with the normal sex difference in ossification.

REFERENCES

1. BAKWIN, HARRY, and BAKWIN, RUTH M. The sex factor in infantile tetany. *Am. J. Dis. Child.*, 1928, *35*, 964–967.
2. BOROVANSKY, L., and HNEVKOVSKY, O. Growth of the body and process of ossification in Prague boys from four to nineteen years. *Anthropologie, Prahe*, 1929, *7*, 169–208.
3. BROOM, R. On the arrangement of the epiphyses of the mammalian metacarpals and metatarsals. *Anat. Anz.*, 1906, *28*, 106–108.
4. PUYHAUBERT, A. Recherches sur l'ossification des os des membres chez l'homme. *J. de l'anat. et physiol. (etc.)* 1913, *49*, 224–268.
5. ROCHLIN, D. G. Ueber die Pseudoepiphysen und deren Bedeutung in der Endokrinologie. *Ztschr. f. d. ges. Anat.*, 1927, *82*, 354–367.
6. STOCKARD, CHARLES R. Rickets in dogs as probably related to sex. *Am. J. Dis. Child.*, 1928, *36*, 310–314.
7. SAWTELL, RUTH OTIS. Ossification and growth of children from one to eight years of age. *Am. J. Dis. Child.*, 1929, *37*, 61-87.
8. SAWTELL, RUTH OTIS. Sex differences in the bone growth of young children. *Am. J. Phys. Anthrop.*, 1928, *12*, 293–302.
9. SAWTELL, RUTH OTIS. How Children Grow: An anthropometric study of private school children from two to eight years of age. Univ. Iowa Stud. in Child Welfare, 1931, *5*, No. 1. (In press.)

THE ROENTGENOLOGIST IN INDUSTRIAL SURGERY*

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ROENTGENOLOGY as a specialized field of medicine has been slowly and steadily pushing its way into every sphere of medical work since its beginning years ago in the days of the static machine. In this manner its growth has paralleled the development of other special branches and its help has been sought and new uses found in these specialties as they have sprung up.

Among the most recent development in these specialized branches has been that of industrial medicine and we find an increasing number of roentgenologists who announce themselves as limiting their work to such a field. The almost universal adoption throughout the country of compensation laws covering the responsibility of the employer in relation to his employee has really forced this development because it must be remembered that it is the medical decision which gives the final word in the vast majority of cases arising under such laws. Again, the employer in his effort to stabilize his working force has come to realize that it is good business to assure his employees the best possible medical care in order that their disability from illness or accident may be reduced to the minimum. Another feature of industrial medicine is the rôle of prevention, the endeavor to weed out prior to employment those who may be especially prone to disability of one kind or another. Probably the most essential respect in which we can anticipate possible disability is in checking the lumbosacral region in industrial employment which requires heavy lifting on the part of the employee. We feel that all of us who have seen the numbers of disabilities resulting from the typical "weak back" syndrome, long transverse processes of the last lumbar, sacralized vertebrae, relaxed sacroiliac joints, not to mention hypertrophic changes, will easily agree that we can save the employer and the insurance company much trouble by advising the elimination of such individuals before employment. Equally valuable is a chest roentgenogram whether or not the prospect is rejected on its evidence. In advising such preventive work it is only that the prospective employee may be placed in the proper kind of work which will not render him especially prone to disabilities. Then, too, there is finally a more selfish side of the matter which renders this work appealing to the medical man, its certainty of remuneration. The per capita fee may be low, his reward may be distinctly less per case treated as compared with his other work, but once he has done his work he need have no concern as to his fee. Either the employer has assumed this responsibility or it has been shifted to an equally responsible agency, the insurance company carrying the risk. In either case, the mind of the physician is free from concern as to the likelihood of payment.

Industrial medicine being so intimately associated with business has in turn taken on a great deal of business atmosphere. Successful operation of this branch of medicine is generally a quantity as well as a quality matter, subject to no great seasonal periods of activity or inactivity, and requiring the same careful attention to the business side as to the medical aspect. Efficiency in the handling of the work must be accomplished, costs must be considered and controlled, careful records must be kept and, above all, is a conscience necessary that there be loyalty to one's self, to one's employer and to those for whom we care.

Within the past year it has been our privilege to have a part in the reorganization of the medical department of one of the large compensation insurance companies. The need was felt for a more efficient survey

* Read at the Thirty-first Annual Meeting, American Roentgen Ray Society, West Baden, Ind., Sept. 23–26, 1930.

of the work in the field as well as locally, to endeavor to weed out unsatisfactory risks, to advise with the safety engineers of the company, to endeavor in some degree at least to standardize methods of handling cases throughout the country, and if possible, to develop an ideally efficient unit of medical care for the beneficiaries of compensation insurance such as would function satisfactorily at any point where there was a sufficient amount of business to justify such a practice rather than handling the cases in the usual way by physicians chosen more or less haphazardly.

With this end in view, there was developed in addition to the local medical staff to which was entrusted the care of the cases coming from the risks carried in the city and immediate vicinity, a home office medical department which has so far consisted of one general medical and surgical man devoting his full time to supervisory work over cases in the field, and the roentgen-ray division handled by ourselves.

The local medical department carries through the complete care of all ambulatory cases which arise as well as provides medical attention for those cases which require hospitalization. A completely equipped clinic has been provided, with adequate facilities for male and female, white and negro patients, and as many as 100 cases daily can be satisfactorily attended. An extensive physiotherapy department is operated in connection with the department, functioning as well in therapeutic measures as in rehabilitation work later on. Finally, there has been provided directly in connection with this department, the roentgen rooms where again every possible facility has been provided to afford all desirable use of this agent.

Thus our work has been of a dual nature, first, that of caring for these local cases, and second, the supervisory work which will be considered later. Just as the company has wished in the ordinary medical care of the patient, to offer every facility to its doctors, so it has also tried to give equal opportunity for the use of the roentgen ray wherever and whenever desirable with no cost limitation, and our remuneration has been under the definite agreement that we provide roentgen service of all natures for the clinic at a certain fixed figure, whether there be one case per day or ten. The determination of a fair rate for such services was arrived at after a detailed study of previous amounts expended and the volume of expected work to be handled. Such a basis of payment as this was chosen because the company officials felt that the aid of roentgenology was of too great importance, wherever indicated, to allow its use to be curtailed by any consideration of directly adding so many additional dollars to the cost of the case by a distinct and separate roentgen-ray charge.

In this manner immediate careful study from a roentgenological standpoint has been encouraged in all cases and many of the errors which are the result of insufficient examinations are avoided. There is no shirking of the clinical examination by the staff but there is also the supplementary check from our side and that too almost as promptly, or in many cases more so, because of the intimate relation of the laboratory to the clinic and its availability at all times. There is no longer the traumatic case which is handled for several days without roentgen examination and which is finally referred when pain, disability and suspicious symptoms persist so long that the physician feels that after all he had better play safe and add the roentgen fee to the cost of the case. It has been our experience that the roentgenologist who succeeds in this special field tends to increase rather than decrease his use of the roentgen ray. The taking of a roentgenogram wherever indicated is expected by the courts, by the companies and finally by the patient. It is becoming too great a responsibility to attempt to limit its use.

We feel that such unlimited use of the roentgen ray has been of great value in a number of skull injuries, where unsuspected fractures have been shown and proper treatment immediately instituted.

A recent experience in the field has shown most forcibly the value of routine roentgenography in the majority of foreign bodies in the eyes. In this case of eye injury it was decided by the oculist that the expense of a roentgen examination might be avoided because there was no evidence of intraocular damage. Nevertheless a little more than a year later the man lost the vision in his eye and the roentgen examination showed a metallic foreign body which was undoubtedly present at the time of the injury. Another feature of such a method of supplying roentgen service is the assurance of adequate examination. Spines can be roentgenographed laterally as well as anteroposteriorly without counting the cost and so we may avoid the failure to recognize a number of compression fractures of the vertebrae.

One thing we have endeavored, however, to discourage in this provision of unlimited roentgen service. This is the endeavor to obtain perfect anatomical results by means of frequent efforts at reduction of fractures. We are not interested primarily in accumulating a series of beautiful roentgenograms showing perfect anatomical restorations of broken bones, but it is good function of the injured part which we seek to obtain. The great fault in this respect, however, does not lie in overzealousness on the part of our medical staff but with the reviewing authorities, the courts and the industrial injury boards who cannot be brought to understand the possibility of good function without perfect alignment of the fractured fragments.

It is in the second phase of our work, that of field supervision, that the concrete evidence which is presented by the roentgenogram manifests one of its greatest values. Here we have not the patient but merely the written record of the manner of injury, the character, a brief summary of the treatment, the bill and the necessity of determining a proper settlement which is of grave importance in all but the simplest cases. Here decisions must be made which may involve hundreds or thousands of dollars. We feel most strongly that the most concrete evidence which can be depended upon at the home office in such cases is the roentgenogram. It is not possible to know intimately the ability of the hundreds of physicians handling cases in the field, their honesty and loyalty in the service of the company, but wherever the roentgenogram forms a part of the record, there is something concrete to decide upon. There is, first of all, the ability more satisfactorily to judge the source of the roentgenographic information because wherever such is available, roentgenologists of recognized standing are employed who can act truly in the capacity of consultant rather than as technician. And wherever there is any question, any doubt, the roentgenogram is available for consideration in the home office where it may speak its own universal language.

In this supervisory work covering the review of field work, there has been manifest in certain localities an apparent attempt to take advantage of the insurance company in the matter. We must remember that the assumption of financial responsibility by the company presumes the guarantee of payment of such charges as would apply to an ordinary patient in similar circumstances. How then can there be any justification of charges amounting to twenty to twenty-five dollars for chests, shoulders, dorsal or lumbar spines, ten to fifteen dollars for extremities? Such instances of exorbitant charges have been confined largely to the man who has merely added a roentgen outfit to his office equipment, who merely takes pictures. In a large number of cases these roentgenograms are of such poor quality as to preclude the possibility of a roentgen diagnosis. Such attempts at exaggerated charges do not result in raising the general level of fees. They merely serve to lose business for that individual and force the company to seek other arrangements where satisfactory service can be secured at a reasonable figure.

We wish to make no attempt to go into any details of roentgenology as applied to

industrial medicine. We have no new technique, no new methods to advocate. All we wish to emphasize is that this field is worthy of our best work and we feel that it should be encouraged in every possible way. Do not permit it to be driven to the employing of its own half-trained roentgenologists or by the use of technicians or commercial laboratories. Let us recognize that we owe some consideration to the insurance companies in the matter of fees and do not feel that they wish something for nothing. They are not heartless corporations but they must count their costs just as we do, and in return for any consideration we show them they will give us accounts over which we need have no concern as to whether the bill will be paid.*

DISCUSSION

Dr. Stanley Clark, South Bend, Ind. This paper is most excellent. I did not have the opportunity to examine it before this meeting, hence my mind has been chiefly occupied in an appreciation of the paper, rather than picking out certain things for discussion. I note that the paper is written from the standpoint of the insurance company, possibly from the standpoint of the employer, and this is timely as it calls to mind the fact that there are two sides to all of these questions. Up to now I hadn't thought very much of the other side of it. We have been mostly concerned with the question of whether we were going to get paid by the insurance company or whether we were going to get the fee that we thought was commensurate for the work done.

A doctor sent over a case and requested that we make only one film because he felt the insurance company would not pay for more than one film. Of course, this is quite ridiculous. It shows entire lack of appreciation of the importance of such roentgen examination.

I feel that the idea expressed of having some sort of a clinic where a flat rate can be charged for all examinations so that each case can have an examination made fitting to that particular case, without regard to the fee, is an ideal situation. In fact, I have felt for some time if arrangements could be made where all kinds of laboratory examinations would be made for a small flat rate for the individual case, that would be ideal.

The relation of the roentgenologist to the insurance companies is one that is constantly with us, perhaps in some form more in the future than it has been in the past, because the cost of these examinations, as suggested in the paper, is higher than it should be, both to the insurance company and to the individual.

Dr. Samuel (closing). We have gone a step further in our work in the reorganization of the medical department of the insurance company that I represent, so that the claim man has no contact with the doctor whatsoever any more. The bills cannot be questioned by the claim department. The bills are sent directly into the medical department where the medical man O. K.'s them, whether it is for surgical, medical or roentgenographic services, and that eliminates a great deal of trouble.

There are men sitting in this room I know (I see quite a number of them; I hoped they would have something to say about it) that we deal directly with, where I am sure they have had no complaint since the reorganization of this department, which was over a year ago. It is going to take us another two years probably to get some of the others of the large companies into line and to realize what we are trying to do. But some of the roentgenograms that have been sent in to the home office from different sections of the country are the worst you can possibly imagine—absolute blanks. How they can attempt to make a diagnosis is beyond me.

* We wish to express our appreciation of the kindness of Mr. W. Irving Moss and Mr. Mike M. Moss, president and executive vice-president respectively of the New York Indemnity Company and the Union Indemnity Company (Insurance Securities Company) who have made this short survey possible. Our thanks are also due to our associates in the medical work of the company, Dr. J. C. Menendez, medical director, and Dr. W. R. Brewster, associate medical director.

MALPRACTICE HAZARDS OF THE ROENTGEN RAY AND INSURANCE AGAINST THEM*

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THE title of this paper might be taken to indicate that I have some special or technical knowledge of the hazards in the use of the roentgen ray that give rise to malpractice suits and claims, so I hasten to assure you that such is not the case. The observations in this paper are those of an interested spectator made from the sidelines, where, through the insurance department of the Medical Society of the State of New York, I have witnessed the trend and development of malpractice claims and insurance for nearly ten years.

It is an accepted fact that the use of the roentgen ray in the practice of medicine embodies hazards peculiar to the specialty and, in some respects, more severe than those in other departments of the science and it seems to me that any approach to the subject of malpractice claims and insurance should first consider some of the hazards that cause claims and make malpractice insurance necessary.

These hazards fall roughly in two general classes, physical and legal.

The physical hazards include faults or dangers in the installation or manner of operating roentgen machines and all other items that have to do with contact with the patient before, during or immediately following roentgen exposure. Roentgenologists are familiar with these hazards and for their own protection, as well as that of their patients, use great care in guarding against them. It does not seem probable, therefore, that I can say anything about the hazards of installation or technique that would be more than mere commonplace routine to you, but there are a few items in this general category that are, I think, worthy of special mention.

Attorneys defending malpractice actions constantly complain of the lack of accurate records upon which to construct convincing defenses. In a malpractice defense, all possible information is required. The defendant must be able to reconstruct in his own mind exactly what occurred. His legal counsel must have precise information upon which to prepare his case and present his arguments, and witnesses for the defense are entitled to exact records of the case so that they can testify with a clear knowledge of the facts. Such information can be obtained only from accurate and complete records made at the time treatments are given. It is not enough for a doctor to "recollect" what occurred or to rebuild his data by translations from hastily scrawled memoranda that mean little to anyone but himself. To be of greatest value, his notes should be *recorded* clearly, fully and accurately, and they should indicate by their form and make-up that they were prepared at the time when the treatments were given. Such records when required can be presented in court as valuable exhibits.

Case records, while showing routine information, covering the setting of the machine, time, distance, volume, intensity of dose administered, protection given to other parts of the body, etc., should also indicate that the patient was adequately advised in advance, of the possible result of treatment, the necessity of and how to protect irradiated areas from subsequent infection, and if possible, include a written acknowledgment of the patient that he had assumed such part of the risk of treatment as are necessarily his. By this I do not mean releases which we all know have little or no legal value. Records of this kind have an extraordinary value when needed in court, and the roentgenologist who does not rigidly hold himself and assis-

* Read by invitation at the Thirty-first Annual Meeting, American Roentgen Ray Society, West Baden, Ind., Sept. 23–26, 1930.

tants to the preparation of such records is a poor malpractice risk as compared with one who does.

Histories of previous treatments are sometimes difficult to get. Patients are frequently referred from other departments of a hospital to the roentgen department without history chart showing what previous roentgen or medical treatments have been given. Some patients are forgetful and when discussing their histories, forget to mention previous exposures for roentgenoscopic examinations or roentgenograms. Other are deliberately untruthful for reasons of their own, usually because they want to check up previous diagnosis and treatment, or to conceal the fact that they are changing doctors. Some want to increase the amount of their treatment, believing that twice as much roentgen therapy will do them twice as much good. We have a record of such a man, who got treatments from three different doctors. After his death, his family sued doctor number three, but, fortunately, information of his other treatments came to light and the case was won by the defendant. Such cases have made roentgenologists despair of always getting proper information, yet however difficult it may be, ways must be found for obtaining accurate histories. You, as roentgenologists, know better than anyone else, how necessary such information is, and I do not mention it with the idea of adding, in any wise, to your consciousness of that necessity. On the other hand, we have had ample cause to wonder if those who have tried to get good histories have always been as successful as they might have been had they used more care in explaining to their patients the vital importance, to them, of reporting all previous roentgen exposures or use of contra-indicated drugs. It would appear, therefore, that enough attention and effort are not yet being given to the matter of obtaining accurate historical information.

The employment of technicians has frequently been cited as one of the elements that make roentgen work more hazardous, from a malpractice standpoint, than other branches of medicine. An examination of 166 roentgen-ray cases by the legal counsel of the New York State Society shows that 40 per cent of them grew out of treatments given by technicians. While it is probably true that other departments of medicine rely upon nurses quite as much as roentgenologists do upon technicians, the difference appears to lie in the fact that roentgen apparatus is always a more powerful agent for inflicting injury than the ordinary instruments used by nurses in general medical or surgical cases. This suggests that much might be accomplished by a closer and greater amount of supervision of the work of technicians.

Under the heading of "Probable Causes," it was found that 42 per cent of the cases were due to over-exposure, caused by errors in technique, setting timing devices, and leaving out filters. Many of these appear to have been preventable errors. If the profession could devise a positive system of checking filters and setting on roentgen machines that would eliminate the careless and preventable mistakes made in those elements, it would do more towards reducing the malpractice hazards of the specialty than could be accomplished in any other way.

The legal hazards are those that affect the malpractice liability of doctors by statutory law or decisions of the courts. These law risks are always present in the practice of medicine in all of its departments. It bears a direct relation to the number of patients treated, the number of treatments and the care and skill employed, not omitting, of course, the results obtained. Every treatment given imposes upon the doctor a definite obligation which is based upon an expressed contract, or one which the law implies. By undertaking a treatment, a doctor, in the eyes of the law, represents that he possesses a reasonable degree of skill and learning such as is possessed by the doctors generally in his locality, and he is required by law to use that skill and learning, as well as his best judgment and

reasonable care, to bring about a good result. Should he fail in any of these requirements and a bad result occurs, the law holds him liable.

But his undergraduate and interne education are not enough because the law requires that he keep abreast of the times; that he keep pace with the ever moving line that marks the accepted progress of modern diagnosis and treatment of human ills.

Having marked the line of his compulsory progress, the law says that he shall not go beyond the accepted methods of modern practice in seeking a cure. A superior court said:

> When the case is one as to which a system of treatment has been followed for a long time, there should be no departure from it, unless the surgeon who does it is prepared to take the risk of establishing BY HIS SUCCESS the propriety and safety of his experiment.

And further, the law holds a doctor to his task and responsibility once he has accepted a patient. A court, in which this question was raised, said:

> When a physician is employed to attend upon a sick person, his employment continues while the sickness lasts and the relation of physician and patient continues unless put an end to by the assent of the parties or is revoked by the express dismissal of the physician.

By these decisions, we are, in effect, directed by the courts to take notice that a doctor must keep up with the modern developments of his profession; that he may not go beyond such modern developments as have been generally accepted, except at his own risk and that once treatment has been undertaken, he must continue his responsibility to the patient until dismissed. These are narrow limits indeed. I know of no other profession or undertaking that is so closely circumscribed as to legal liability.

In malpractice cases, a bad result does not, in itself, indicate that the doctor has been negligent, and, therefore, is liable. Judge Taft, before going to the Supreme Bench, forcibly pointed out that the principle of "*res ipsa loquitur*" should not apply to malpractice cases. However, plaintiffs' lawyers constantly try to induce the courts to apply this rule and in at least two States, courts have ruled that roentgen burns may be taken as "*some evidence*" of negligence. In time, other States may follow that lead. Regardless of the present clear prohibition of the rule, it is probably a fact that the mere existence of a burn has a prejudicial effect upon the minds of many jurors and no effort should be spared to correct that attitude when an opportunity is presented.

While the burden of combatting unfavorable legal rules and principles rests with attorneys for the defense, roentgenologists should miss no opportunity to inform themselves regarding them so as to be able to give their attorneys the maximum amount of assistance when needed, and to guide them in their own practices.

These physical and legal hazards and many others with which everyone is familiar have combined to make malpractice exposure a troublesome question for the medical profession and for the insurance companies who issue policies against them. As long ago as 1921, the companies began to see that the risk of insuring roentgen therapy required a higher rate than did other departments of medicine but it was not until 1924 that roentgen therapy was excluded from general policies and a higher rate charged. This action on their part put the whole question squarely before the profession and there it rests. Since 1924 there has been little change in the *cost* of therapy *losses* so the insurance rates established at the time have remained unchanged. If these rates are so high as to worry those who buy insurance, it is only because the cost of furnishing it is so high that it worries the companies that sell it. That these rates are high compared with the rest of the profession is apparent but whether they are excessive when compared with the cost to the companies is quite another question, and one that is worthy of thought.

In approaching this question, we must first get some idea of what *cost* means to an insurance company. There are a number of complicated items of reserve, for unearned premiums, reinsurance, etc., that need not be gone into here. It will be enough for our purpose to consider only the three items of Losses, Expenses and Profit. Losses and Expenses are referred to as Loss and Expense Ratios, meaning the ratios of these items to premium income. Loss Ratios for liability insurance are made up of three items; suits and claims closed and disposed of, referred to as Paid; reserves for those that have been reported but not yet disposed of, referred to as Outstanding; and reserves for suits and claims not yet reported but for which the Company is liable. These are referred to as To Arise.

From this it will be seen that in considering whether rates are too high, it is not enough to base our estimates only on what we can learn about judgments given to plaintiffs.

Paid Losses include, in addition to judgments given to patients, all claims settled without trial and the cost of defending suits both lost and won. These items are frequently, if not always, far in excess of the cost of judgments paid. All suits and claims, however, cannot be disposed of in the year in which they are reported. Some of them remain open on appeal or for retrial for several years. The ultimate cost of disposing of them is estimated and becomes a part of the Loss Ratio as Outstanding. Some idea of the important effect that this group has on the Loss Ratio may be had from the fact that although the attorneys for the New York State Society dispose of about one hundred and twenty-five suits each year, they always carry over between five and six hundred suits as Outstanding.

The third group, called, To Arise, is not quite so easy to understand but a company's liability for them is none the less real. Perhaps this group can be explained as follows: Suppose upon any given date, when a company wanted to compute its loss ratio, it were to stop issuing malpractice policies. Although it would have no new liability after that date, it would still be liable for all claims growing out of treatments given prior to that date and the liability would continue until the statute of limitations had expired for every treatment given. In New York State we find that the average lapse of time between treatment and bringing suit is about twenty-two months. Thus companies always have a liability for suits and claims which are certain to accrue, but which have not yet been reported to them, and they have had to devise accurate methods of ascertaining what the probable number and money value of those claims will be for inclusion in the Loss Ratio.

It is not until these three groups, Paid, Outstanding, and To Arise, are computed, drawn off and added together that we get some idea of what a company's loss liability really is, and it takes many years before the experience thus tabulated can be accepted as accurate data. For instance, in New York, where we have carefully compiled data covering uninterrupted operations for nine years, only 40 per cent of our loss experience is represented by closed claims, the other 60 per cent being divided about equally between Outstanding and To Arise.

Next, there is the matter of Expense Ratio. This covers the entire overhead expense of operating a company, including taxes and acquisition cost. This varies somewhat from year to year and between companies, but the exact figures for any company can be obtained from its annual statements filed with the Insurance Departments of each State. By checking those figures for the ten leading liability companies in America for the past ten years it is found that the average expense ratio for the period was about 43 per cent. Perhaps some idea as to whether this percentage is high or low can be ascertained by comparing it with a doctor's expense ratio, that is, the ratio which the entire cost of operating his professional business, including a fair salary to himself, bears to his total professional income.

Last in the schedule is the item of Profit, and while we have no access to figures showing the companies' rate loading for that item, we know that they are very moderate, probably less than 5 per cent in malpractice rates.

If we assume that the profit loading for malpractice insurance is 2 per cent, we see that the Expense Ratio and Profit together equal 45 per cent, leaving 55 per cent of all premiums collected available for losses. Or, stated conversely, the liability for all losses, Paid, Outstanding, and To Arise, represents 55 per cent of the total premiums which the company should have collected to be able to pay its expenses and make an underwriting profit of 2 per cent. If, having ascertained what that amount should have been, we divide it by the number of policies issued during the period under consideration, we would then know what the cost per policy or the premium rate should have been.

When we have thus analyzed what cost means to an insurance company and thereby obtained a clear idea of the enormous liability that the company must carry for a period of years, then and only then, can we form some idea as to whether or not their rates are excessive.

Let us take an example by way of visualizing what these figures mean. Suppose that the rate for a $5,000 roentgen therapy policy is $100. Would any one be willing to take this amount from a fellow practitioner selected at random, use $45 of it for expenses and profit, and with the other $55 laid away in the bank as a reserve, assume all of his malpractice liability up to $5,000 for a year, and in addition, agree to pay perhaps $1,000 or $2,000 more for the cost of his defense, including appeal, retrial and reappeal, if necessary? Knowing what we do about the hazards of roentgen therapy, I have no doubt that the answer is "No." And if the answer is "No," then what must we conclude as to the adequacy of a $100 rate for $6,000 or $7,000 worth of malpractice indemnity and defense protection?

I find there is a general impression among roentgenologists that use of the roentgen ray by men without proper education or experience is largely responsible for the present so-called high level of rates, and I should like to take this opportunity to correct that idea. Our records show that only a little over 25 per cent of the x-ray suits filed are against general practitioners or others owning roentgen apparatus, and having no special training or experience in its use, while nearly 75 per cent are against specialists on account of their own treatments or those given by their technicians or nurses.

In buying insurance, there are a few simple rules to keep in mind.

First: Since a doctor's good name may be at stake in a malpractice action, select the company that has the best malpractice defense attorneys in your State.

Second: Be sure that the company is legally licensed to do business in your State. Non-entered insurance companies can, under interstate law, legally solicit your insurance by mail, but under most State laws their representatives cannot enter the State to transact any part of their business (and defense is a very important part of their business) without being liable to arrest and prosecution under penal statutes. Furthermore, you will not have recourse against such companies in the courts of your own State and should it become necessary for you to press a claim against them you will have to travel to some State in which they are domiciled in order to get service upon them. No leading liability companies will issue policies to residents of States in which they are not entered.

Third: Beware of cut rate companies unless you are prepared to accept cut rate indemnity and defense. The insurance managers of all of the great buyers of insurance in the country have long since learned that lesson and none of them will accept a cut rate policy. I think it was the insurance manager for Marshall Fields, in Chicago, who said, "Good insurance is never cheap, and cheap insurance is never good."

Fourth: Buy as much good insurance as you can, consistent with your needs, and your pocketbook. A minimum policy of $5,000 is far better than none at all but it is cold comfort when one is faced with a $25,000 or $50,000 suit.

In his invitation to me, your president asked me to say something about how malpractice suits can best be averted. This paper has attempted to outline some of the hazards that are commonly encountered and to suggest ways in which they might be avoided. They may be recapitulated as follows:

1. Make accurate, clear and complete records at the time treatments are given, taking care to show what information and instructions were given to the patient.

2. Get accurate histories covering all information required even if you have to press for it. Particularly avoid the perfunctory compiling of histories by unskilled assistants.

3. See that your patients get and understand proper instructions as to how to care for irradiated areas so as to protect themselves and you. Especially warn them of the dangers of additional exposures on the same or adjacent areas until directed by you.

4. Leave as little to your technicians as you can and supervise that little as closely as you can.

5. Check all settings and filters on every machine for every treatment, if possible.

These are only a few of the do's and dont's that should be followed, all of which, of course, are routine matters to you. Yet roentgen-ray suits continue to be caused by failure to observe these simple rules and so perhaps they will bear the discussion they have had in this paper.

But, after all, this is only piece-meal advice. No real progress will be made until the profession itself takes the whole subject in hand. Insurance companies will help but they will not lead. So long as they can collect premiums that adequately pay them for the risks which they assume, they will be content and when adequate rates are no longer available for any particular kind of risk, they will discontinue insuring that risk. Insurance rates merely measure the hazards of the risks covered and the hazards of roentgen practice cannot be attacked and modified or eliminated by anyone except roentgen-ray specialists. They can do much to reduce those hazards and we may be sure that insurance rates will quickly reflect any resulting decrease in losses.

As an example of how one group of men helped themselves, the following may be of interest:

About fifteen years ago the cotton seed oil mills of the South burned so often that fire insurance companies refused to protect them. Their rates were raised from time to time, but most of the companies still refused to insure them as it appeared that no rate under 100 per cent would be adequate.

About that time an old and well established firm of New York brokers undertook to see what they could do with the business. They spent several years and a great deal of money studying the cotton seed oil mill hazards and devising standards of construction and operation that would eliminate, as far as possible, the hazards that had been causing the losses. They formed into a group, mill owners who were willing to comply with their code of standards and they refused to admit to the group any owner who would not comply with the code as a whole. This group was then offered to the insurance companies and a few hardy ones were persuaded to experiment with it. The experiment worked and more mill owners complied with the code and more companies were willing to underwrite the business until today most of the fire hazards that beset the cotton seed oil mills of the South have been eliminated and they have no trouble in buying their fire insurance at reasonable rates from any of the substantial companies.

To accomplish similar results in roentgen practice would require a great deal of time, courage, patience and some money. It would need keen roentgenologists using uniform report forms and the aid of competent office help to begin the systematic collection of data bearing on the hazards that produce

malpractice claims. The insurance companies would be willing to furnish all the information they have bearing on this point, in fact, they might prove to be the chief source of information.

When all of the information had been received, classified, tabulated and studied, a code covering the manufacture, installation and use of apparatus could be formulated; beneficial laws drafted for introduction in legislatures; uniform record and history charts devised and a program for educating the other branches of medicine as the powers, and limitations of the roentgen ray and the dangers in the use of contraindicated drugs could be undertaken.

Some doubt might be expressed as to how far roentgenologists generally could be induced to follow such a code. It might not be easy but the insurance companies could lend effective assistance, by refusing to insure non-conformists, or by endorsing their policies so as to make them void on account of claims caused by failure to comply with requirements of the code.

If such a plan were carried out, there can be no doubt that a substantial reduction in hazards would follow. The number of malpractice claims would diminish and insurance rates would shrink. Fewer patients would have bad results and that would be a blessing to the public and profession alike. It seems to me that no finer or effective activity could be undertaken by those who have the best interest of roentgenology, as a specialty, at heart.

DISCUSSION

DR. B. R. KIRKLIN, Rochester, Minn. I think this Society owes a debt of gratitude to Mr. Wanvig for his time and trouble in coming out here to tell us of his experience in this particular field.

Mr. Wanvig was instrumental in securing for the Committee on Laws and Public Policy practically all of our data on this insurance problem. You might be interested to know that he is the insurance representative of the New York State Medical Society. He is not representing an insurance company, as some of you might feel from the tone of his paper.

I want also to endorse everything that he has said from my experience and the experience of the Committee in investigating this problem for the past two years.

I think it would be very interesting and perhaps more profitable if we would spend the time allowed for discussion in considering certain questions which some of you may wish to ask Mr. Wanvig, for he is in a better position to give an unbiased opinion on this matter than anyone I know. We hope to have a more detailed report at the executive meeting this afternoon, and I trust that Mr. Wanvig will be privileged to attend this session.

DR. L. T. LEWALD, New York City. I want to ask one or two questions about the physical hazards. Seeing Dr. Bowen here reminds me of his story of how a tube support broke and, as he expressed it, "The patient came into the x-ray laboratory *without* a fracture and went out *with* a fracture." What insurance would cover that sort of a hazard? I have been told that that does not come under the malpractice insurance, but under some form of public liability insurance. I think very few roentgenologists carry public liability insurance. I do.

Likewise, a mother holding a child comes in contact with the high tension current and receives a shock, where does the liability come in under that accident?

A patient slips in the fluoroscopic room getting on or off the table and breaks her leg. What form of insurance covers that?

I know of another case that is quite far removed. A patient in the waiting room saw another patient drop her fur as she went out, and rushed out to give her the fur and slipped on the floor and broke her leg. What about that?

Some of these are quite remote, but some of them are so closely related to roentgen work that it would seem as if either the general liability covered by a liability policy should be taken out or that the question of the malpractice liability should be distinctly stated to cover at least some of these hazards such as the one I first indicated.

DR. JOHN T. MURPHY, Toledo, Ohio. This problem of protecting the insurance company to protect yourself is one that has caused me a good deal of trouble. I have tried to meet it in several ways. I have even thought that at some time I would hire a special stenographer to go into the room when I talk to a therapy patient

and have this stenographer take down a verbatim report of the conversation. The only reason I haven't done that is because of the expense.

We have, however, tried to meet it in one way. We have a printed card which every patient receives, telling them what we are doing, and the dangers of any application to the surface that has been irradiated. We go so far at times if we think the patient's mentality is a little low, to forbid even the taking of baths, because if you allow them to do this, the first thing they do is take the bath, and put a lot of alcohol and other drugs on the surface irradiated.

We give each one this card. In this way I think we have helped protect ourselves, at least, we have a record that they have this card in case of suit. We try to keep as complete records of the treatment as possible. It has been brought to me many times after I have talked with the patient, with the patient's husband or wife or family and carefully explained just what we are going to do, they come in the next time without any conception of what has been said. A stenographic report is the only safe method. Take down the conversation verbatim and keep this with the patient's record. This would be expensive, but if it could be carried out all through the country, I think Mr. Wanvig would agree that it would help in reducing the number of suits.

Dr. George W. Holmes, Boston. I would like to call attention to a procedure which I have found is of considerable importance; that is the making of a careful note on the physical condition of the patient, particularly the skin, before beginning treatment and preceding each subsequent treatment. If you have such a note in your records (it is a thing most of us are apt to neglect), it may help you should a question of injury arise. A patient may have some blemish on the skin or he may have a sunburn which he attributes to the roentgen rays and suits are brought through such misunderstandings. I have been asked to defend men being sued, where if a careful note had been made of the condition of the skin there would have been no possibility of a successful suit.

Dr. G. E. Pfahler, Philadelphia. I would like to endorse all that has been said. I would like to add that for many years, probably fifteen, I have been doing as Dr. Murphy does, handing each patient a slip of paper printed with cautions on it of the things they should not do, as well as some that they should do. I think that is of some help.

With regard to the omission of the filter, which is a very important matter, in the low-voltage treatment outfits in which we are apt to be using the equipment for other than therapeutic purposes, many years ago I recommended the attachment to each filter of a ribbon which which would hang down and indicate not only that a filter was present, but the character of the filter to the person who is looking on. Since that date, about four years ago, Professor Holzknecht, of Vienna, has recommended a better procedure which I have adopted, and that consists of attaching to each filter—this has been described in our Journal—a string which is attached to two hooks. One hook is attached to the high tension wire which connects to it and the other hook attaches to the tube or to another wire, so that the two rings can never be hooked together and the current started until a filter or an indicator that there is no filter in is hung in that circuit. That is a simple, inexpensive device which will go a long way toward eliminating that element.

For high voltage work, as some of you know, many years ago I described an electrical attachment which would ring a bell whenever the machine started, providing there was no filter in the circuit. That is a procedure that can be applied. But an even simpler procedure which we are using at the hospital on our equipment particularly, is this: We screw in place 0.5 mm. of copper for deep therapy, and if that is taken out, it must be taken out with screws and a screwdriver, and it is usually a very conscious procedure.

While in Germany this summer, I took note of another arrangement which will be a guide and which may be adaptable to certain equipments. During the process or the time when the high voltage therapy tube is being brought up to its full value, in other words, warmed up, and during which time you must either guess at your radiation value or ignore it, or ignore the error, they meet the situation by placing in the circuit a lead filter of approximately an eighth of an inch in thickness, I think it is 3 millimeters, to be exact. Then when the tube becomes properly warmed, that lead filter is withdrawn, but it cannot be withdrawn without putting in place the proper copper filter that you intend to use. All those simple mechanical devices are helpful.

Still another device that we are adding, and which is further helpful, is to have two people check on both the voltage and the filter in each instance to know that it is proper, and the initials are recorded with the treatment.

MR. WANVIG (closing). Dr. LeWald has asked about what happens to a patient who is injured by a tube stand falling on him. We have had a number of such cases due to the counterweight cable breaking and letting the tube stand down on an arm or leg and breaking it. In those cases the relation of the physician and patient exists between the person who is injured and the doctor giving the treatment. His malpractice policy covers him for an injury of that kind, just the same as it would for an overexposure.

In the case of the mother holding an infant on the table, we have quite a different situation. The relation of the physician and patient does not exist between the mother and the doctor. The mother is there in the service of the patient and not as a patient of the doctor. If she is injured by coming in contact with a high voltage wire, either directly herself or as in one case we had in Westchester County, where the infant threw up his hands and came in contact with the wire and injured both the mother and the grandmother, those cases are not covered by malpractice policies and, as Dr. LeWald says, in order to be protected, the doctor should have a General Liability policy. As a matter of fact, he should have it anyway. Those policies are very inexpensive, yet you never know when someone coming in is going to fall over a rug, slip on the stair, or perhaps the postman or the grocery boy slip on some ice on your steps. Since it is so cheap, there is little excuse not to have a General Liability policy anyway.

He spoke about a patient slipping and falling while getting on the table; I think he said for fluoroscopic examination. That is just the same as a tube stand; that is an accident which happens incident to and as part of the treatment, when the relation of the physician and patient exists between the two parties and is covered under the malpractice policy.

Slipping on the floor in the office is a General Liability matter and that happens many times; either a patient, or one who is not yet a patient, but comes to the office expecting to become a patient of the doctor, slips on a rug. We had a chair break in New York and the patient injured. We have had patients walk into the office and knock over a vase and be cut, a patient walking into the doctor's examination room and knocking over, I think it was, a retort in which there was some boiling liquid, and was burned. Those things are not incident to the treatment and should be covered, if at all, under General Liability policy.

Dr. Murphy referred to stenographic reports. Nothing could be finer. The profession, as a whole, would do itself a great service if it followed that invariably.

The matter of cards being given to patients with full instructions is an excellent idea, but I should like to suggest that the cards should not only be given to the patients, but read to the patients in the presence of witnesses, and be sure that the patients understand what is on those cards.

I was very much interested in what Dr. Pfahler said about marking filters. I have seen some curious devices. I know of a man who has his machine so decorated with ribbons that it looks like a circus procession. He has got them so prominently displayed that glancing through the window, his technician or himself or the nurses, everyone, can see at an instant whether those filters are in place or not.

He also spoke about connecting the filters through the current. It is my opinion that the profession should demand and get from the manufacturers of instruments, of apparatus, safety devices built into those machines that are infallible. I believe that if the profession demanded it, they would get it. Contacts built into the tube stand so that by merely turning a switch (on a machine which is used for roentgenography and treatment) over to the therapy side of it will immediately connect up the electrical telltale equipment to show whether or not a filter is in place and possibly prevent the current from getting into the tube itself if the filter is not in place would be a great improvement. It is not a very difficult thing to do, and the only reason it hasn't been done and done successfully is because the profession hasn't demanded it.

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UTERINE HEMORRHAGE WITHOUT DEMONSTRABLE PATHOLOGY*

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OF ALL the conditions that yield to radiation therapy few are more satisfactorily dealt with than chronic uterine hemorrhages occurring in patients whose pelvic organs reveal no definite organic abnormalities. Advances in our knowledge in this field should therefore interest the radiotherapist and the gynecologist alike.

The condition is a very common one but so many names have been applied to it that the casual observer is led to believe that he is dealing with a large number of diseases. Some of the diagnostic terms encountered in the literature and in hospital records are "idiopathic, essential or functional menorrhagia," "uterine insufficiency," "endometrial hyperplasia," "fibrosis uteri," "subinvolution of the uterus," "uterine fibroids," "metropathia hemorrhagica, "glandular cystic hyperplasia," "ovarian hemorrhage," "endometritis glandularis," "adolescent menorrhagia," "menopause hemorrhage," etc.

Meigs,[18] in analyzing a group of 243 patients who came to the tumor clinic of the Massachusetts General Hospital complaining of uterine bleeding, found that the diagnosis "menorrhagia without demonstrable pathology" was made 66 times. In other words, 27.1 per cent of these patients were so diagnosed and no other condition appeared so frequently. Carcinoma of the cervix ranked second in frequency in this series and fibroids came third. Since this study was made in a tumor clinic it seems most probable that the percentage of patients without demonstrable pathology would run much higher in general practice.

Any intelligent study of menstrual irregularities must of necessity begin with the normal mechanism of menstruation. This mechanism is not as yet thoroughly understood but the more recent theories are interesting. The diagram shown in Figure 1 illustrates the most generally accepted explanation of the menstrual cycle. The development and ripening of the Graafian follicle in the ovary is stimulated by a secretion from the anterior lobe of the pituitary known as the ovulation hormone. The presence of such a secretion is assumed because of the experiments of Smith and

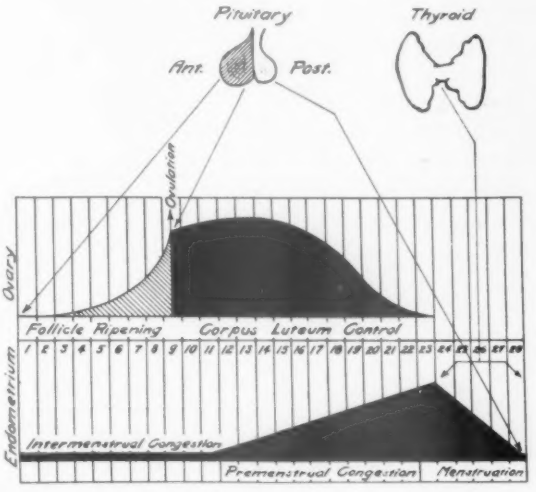

FIG. 1. Diagram illustrating the interrelationship of the ovary, pituitary, thyroid and endometrium during the normal menstrual cycle.

Engle[29] and of Zondek and Aschheim.[32] They have shown that the ovaries of immature white rats become tremendously enlarged soon after the transplantation into their bodies of fragments from the anterior pituitaries of mature animals. The ovarian enlargement is due to a marked acceleration of the development of the Graafian follicles with normal ovulation and corpus luteum formation. The follicles, as they develop, elaborate a follicular hormone which causes a proliferation of the basal

* Read at the Thirty-first Annual Meeting, American Roentgen Ray Society, West Baden, Ind., Sept. 23–26, 1930.

layers of the endometrium resulting in an intermenstrual congestion. This hormone has been obtained from the follicular fluid by Allen and Doisy,[1] who demonstrated its ability to induce the estrual cycle even in castrated experimental animals. Similar experimental evidence of the potency of this substance has been published by Frank.[10] About nine days after the end of a menstrual period the Graafian follicle ruptures and the ovum is discharged. The exact time of ovulation is not always the same but Novak[23] has shown that it occurs in the first half of the intermenstrual period. The walls of the follicle now show marked changes and the corpus luteum is formed. The work of Evans and Long suggests that the "luteinization" of the follicle is brought about by another secretion from the anterior lobe of the pituitary. They injected an extract from the anterior lobe of the beef pituitary into experimental animals and produced many corpora lutea in the ovaries. In a number of the animals ovulation was so interfered with that ova were imprisoned within the corpora lutea. Evans and Simpson[6] have obtained a similar effect with an extract of the anterior pituitary prepared by a special method.

The cells of the corpus luteum next elaborate a hormone which has a very marked effect on the endometrium, producing a premenstrual congestion or pregravid change. The lining of the uterus becomes thickened and congested. This function of the corpus luteum has been assumed for a long time but the work of Corner and Allen[3] seems definitely to prove its existence. They found that the removal of the corpora lutea from the ovaries of rabbits that had fertilized ova in the tubes for from four to ten hours completely prevented the pregestational thickening of the endometrium. None of the embryos survived beyond the fourth day.

In the event that fertilization does not take place, the corpus luteum begins to show a definite regression about ten or twelve days after its appearance. It is at this time that menstruation occurs with a desquamation of the more superficial layers of the endometrium and hemorrhage from the underlying vessels. After four or five days this process ceases and the cycle starts all over again. Since pituitrin which is prepared from the posterior lobe of the hypophysis has such a definite effect on the uterine muscle and is so effective in checking uterine hemorrhage, it seems not entirely illogical to assume that this substance may be instrumental in stopping the normal menstrual flow. However, no definite proof of such a normal function is available.

All of the glands of internal secretion may be in some way related to menstruation. Certainly the thyroid, the automatic governor of many of the activities in the body that are not under the direct control of the brain, also plays a part in its regulation. It is a well-known fact that patients suffering from myxedema are likely to complain of menorrhagia, whereas the hyperthyroid subject is more likely to have an amenorrhea. The relations of the adrenal, pancreas, parathyroid, pineal and thymus to uterine function are so poorly understood that they will not be discussed in this paper.

ETIOLOGY

Having reviewed the mechanism of normal uterine bleeding, we may now turn to the explanations of abnormal hemorrhages that occur in the absence of demonstrable pathology. Novak[24] has covered some of the earlier literature. He states that Scanzoni in 1863 ascribed the bleeding to an infection of the myometrium, whereas Olshausen in 1875 felt that it was due to a hypertrophy of the endometrium which he called "endometritis fungosa." Theilhaber described an insufficiency of the uterine muscle due to its replacement by fibrous tissue and Anspach found some abnormalities in the elastic tissue of the blood vessels of the uterine wall. Pankow, Rees and Findley thought that arteriosclerosis of the uterine vessels played an important part in the causation of the hemorrhage. It is

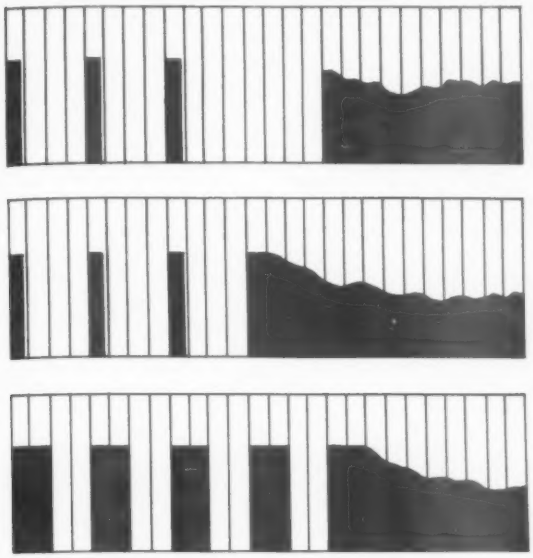

FIG. 2. Graphs taken from Shaw's article[28] representing three different types of menstrual irregularities met with in metropathia hemorrhagica. Each vertical line represents one week, and the height of each shaded section represents the amount of blood lost.

interesting to note that in 1882 Brennecke wrote of a condition which he called "endometritis ovarialis." He attributed the hemorrhage to some ovarian disorder. Novak and Martzloff[25] describe the marked hypertrophy of the endometrium encountered in their cases and suggest abnormal function of the ovary as an etiological factor.

A recent article by Shaw[28] is of unusual value in that it contains a correlation of clinical data with operative and histological findings in a rather large series of patients suffering from uterine hemorrhage where little or no demonstrable pathology was present. The series contained 200 cases, many of which were operated upon. In 35 patients the material at hand did not offer any definite explanation of the symptoms. In 13 the hemorrhage could be explained by the presence of a real endometritis. The remaining 152 cases were divided into four groups which will be described in some detail.

The first group was called *metropathia hemorrhagica*, a term originated by Schröder,[27] and included 53 patients. The ages of the women included in this classification varied from puberty to fifty-five, though the majority were between forty-one and fifty. Their chief complaint was a continuous menstrual flow lasting from three weeks in one case to five years in another. The method of onset differed somewhat as shown in Figure 2. Forty-nine per cent of the group had a long period of amenorrhea before the hemorrhage appeared, as indicated by the upper chart; 26.4 per cent had no preliminary irregularity as shown in the middle chart. The lower chart represents the presence of a regular preliminary menorrhagia which occurred in 9.4 per cent of the cases. Four other patients had a marked irregularity of the preliminary menstruation.

In 18 patients the uteri were removed

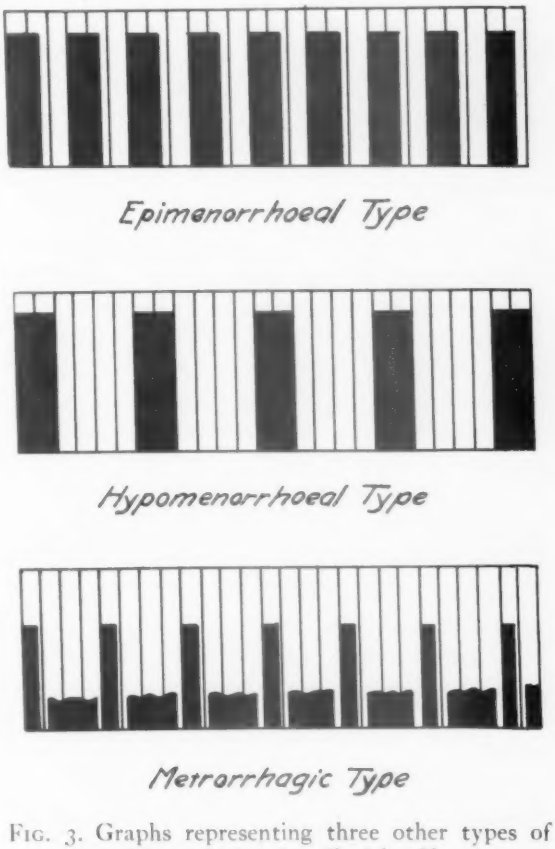

FIG. 3. Graphs representing three other types of menstrual irregularity described by Shaw.

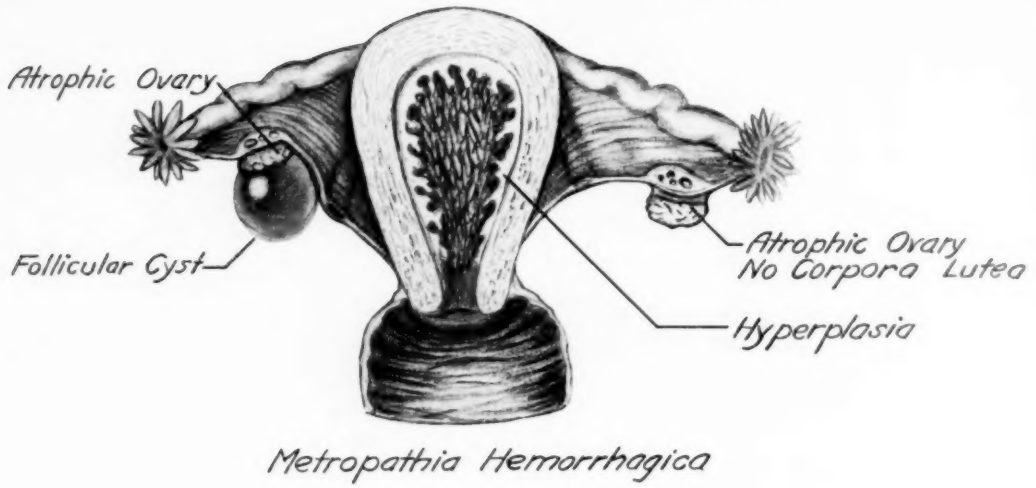

Fig. 4. Schematic drawing illustrating the operative findings in Shaw's patients having the types of menstrual abnormalities illustrated in Figure 2.

and studied. In 9 cases there was some uterine enlargement present due only to myohyperplasia, whereas in the other 9 the uteri were normal in size. In all cases the endometrium was markedly thickened and showed many polypoid and sessile protrusions from which blood was oozing. The surface epithelium showed many areas of disintegration and the glands contained a number of dilated cysts. The glands were markedly hypertrophied, increased in number and closely packed together. However, the appearance was that of intermenstrual rather than premenstrual congestion. In every case one or more small follicular cysts were found in only one ovary and both of the ovaries showed marked atrophy. In almost all of the cases there were either no corpora lutea present or only old scars were found. The outstanding characteristics of this condition are retardation of ovarian function with ovarian cyst formation and hypertrophy of the myometrium and the endometrium

Shaw's second group was much the largest one since it included 72 cases, or 36 per cent of the total number. He calls the hemorrhages occurring in this group the *epimenorrheal* type. Most of the patients ranged from forty to fifty years of age although a few were younger. The outstanding clinical manifestation was a reduction in the menstrual cycle with a prolongation of menstruation and a marked increase in the amount of blood lost each day as shown in the upper chart of Figure 3. In most of the cases the uterus was smoothly enlarged to three or four times its normal size as a result of myohyperplasia. An occasional small fibroid was encountered. Operative material was scanty in this group but enough pelvic organs were obtained to give considerable information. In most of the cases the endometrium had a normal thickness or was thinner than normal but its middle zone showed a definite hyperemia and edema. The ovaries were shrunken and grooved and contained hemorrhagic cystic follicles. Histological study showed that some of these cysts represented corpora lutea of about the same age. Others were older corpora lutea which had not retrogressed as they should. An abnormally large number of follicle cysts were also found. These findings suggest that the ovaries have been stimulated to marked overactivity in some way.

Group III designated as the *hypomenorrheal* type contained only 16 cases whose chief complaints were an increase in the length of the menstrual cycle with prolonged menstruation and an increase in the

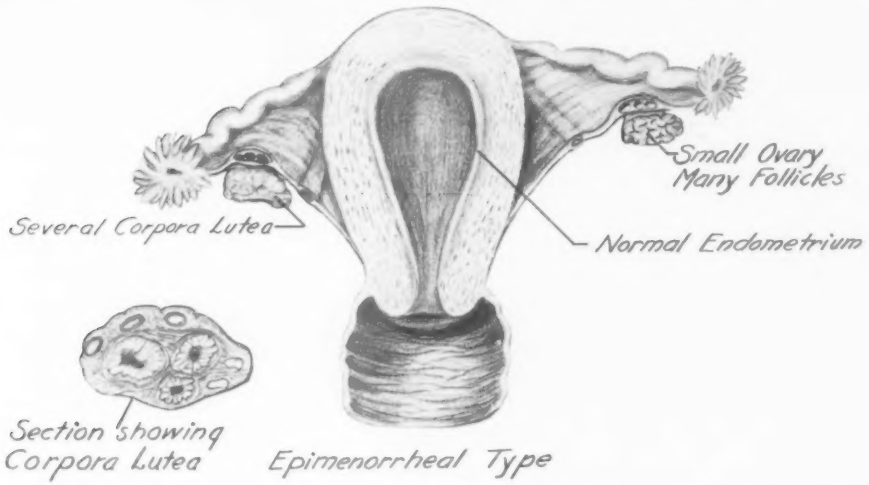

Fig. 5. Findings in pelvic viscera of patients suffering from the epimenorrheal type of uterine hemorrhage illustrated in Figure 3.

amount of blood lost each day. Their ages varied from twenty-six to fifty-one, but only two were less than forty. A small amount of operative material was available for study in this group. Fibroids accounted for some enlargement in 3 uteri but in only one of the others was there any myohyperplasia. The endometrium showed edema and hyperemia in every case and some hyperplasia was found in 5 cases. The ovaries showed very few abnormalities. In one case ovulation was delayed and in another large follicular hematomata were present. It seems hardly possible to explain what has taken place in this group of cases without more data.

The fourth group contained 11 cases and was characterized by moderately severe vaginal hemorrhages which occurred between perfectly normal menstrual periods. These hemorrhages were designated as the *metrorrhagic* type and appeared in patients varying from twenty-nine to forty-five years of age. Most of them were less than forty. The uteri showed no abnormality but the endometrium showed some edema and an extreme hyperemia without hyperplasia. No degeneration of the type seen with menstruation could be made out. The ovaries revealed hyperplasia and hypertrophy with many follicular cysts and abnormally developed corpora lutea. The au-

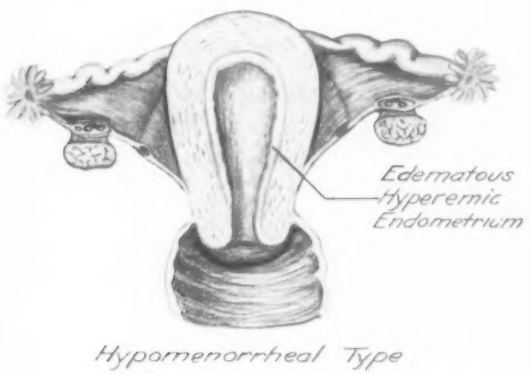

Fig. 6. Indefinite findings in pelvic organs of patients suffering from hypomenorrheal type of bleeding illustrated in Figure 3.

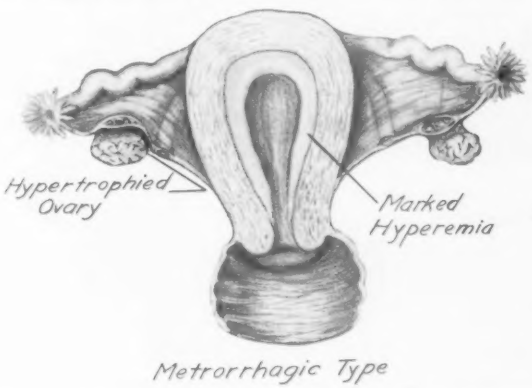

Fig. 7. Findings in the rare cases having the metrorrhagic type of uterine hemorrhage illustrated in Figure 3.

thor suggests that the metrorrhagia results from oozing through the hyperemic endometrium which is in turn produced by the overdeveloped ovaries.

Although it is impossible to correlate all of Shaw's data satisfactorily, he has undoubtedly shown that most of the hemorrhages occurring in patients without demonstrable pathology have an endocrine origin with the ovary playing an important rôle in the mechanism.

Fluhmann[8] has recently published some quantitative determinations of the pituitary hormones in the blood in menstrual disorders which suggest that the real source of the trouble may lie in the hypophysis.

DIAGNOSIS

When a patient with chronic uterine hemorrhage presents herself for treatment, a careful study of the case should precede any attempt at therapy. The radiotherapist who wishes to fit his treatment to the individual must either be prepared to make this study himself or to obtain the information from some reliable source. A detailed history outlining the time of occurrence, duration and amount of the excessive flow, the presence or absence of pain, the occurrence of vaginal discharge, the relation of pregnancies and miscarriages, the presence of weakness, anemia, subjective symptoms, etc., is of great importance. A bimanual examination with inspection through a speculum is then necessary ro rule in or out the presence of pelvic inflammation, polyps, cervical lacerations and erosions, ovarian cysts, carcinoma of the ovary, carcinoma of the cervix, fibroids, malpositions, senile vaginitis, etc. The patient should also have a complete blood study, including a Wassermann and a basal metabolic test. This laboratory work may, as Meigs[19] has pointed out, establish the diagnosis of purpura or hypothyroidism and alter the plan of treatment completely. Syphilis is also a cause of menorrhagia which demands specialized treatment. The next step is one of major importance and consists of a curettage followed by a microscopic study of the endometrium done principally to eliminate the presence of carcinoma of the fundus of the uterus. If all of these examinations are negative except for some smooth enlargement of the uterus, possibly accompanied by a slight ovarian enlargement and in some cases a hyperplasia of the endometrium, a diagnosis of "menorrhagia without demonstrable pathology" may be made, though the classification is not strictly accurate. For a number of years it has been our custom to carry out these examinations in a small gynecological room included in the layout of the hospital radiological department.

TREATMENT

In selecting therapeutic methods it is best to divide the patients into two groups: those who being forty years of age or past may have an artificial menopause, and those who being less than forty should have their menstrual activity preserved if possible.

The treatment of the first group is simple since the administration of sufficient radium or roentgen therapy to bring about a menopause usually produces a cure. It is our custom to admit the patient to the hospital at 11 A.M. at which time she is given a drink of milk containing 10 to 15 gr. of amytal. She then receives the regular preparation for a curettage. At 2 P.M. a stuporous condition has appeared and she is transferred to the gynecological room where the cervix is gently dilated and a curettage done. If the dilatation is painful, gas and oxygen are given for a few minutes only and a well-filtered radium capsule, usually containing 50 mg. of radium, is packed into the fundus of the uterus. This capsule is removed after twenty to twenty-four hours and in most cases a full dose of copper-filtered high voltage roentgen rays is administered over the pelvis to make the result doubly sure. After two or three days' rest the patient returns to her home. If she has lost enough blood to produce a secondary anemia she is put on an anemia diet containing liver, red meats, fruit, vegetables,

milk, etc., and asked to take a teaspoonful of iron and ammonium citrate dissolved in a glass of milk after each meal.

The administration of large doses of amytal abolishes most of the evil after-effects of the anesthetic and reduces the nausea usually produced by intrauterine radium treatment to a minimum. In fact, most of the women treated in this manner sleep from eighteen to twenty-four hours and suffer little or no inconvenience. The curettage serves two useful purposes: in most cases it checks the hemorrhage immediately and holds it in check for two or three weeks until the radiation therapy can take effect; it also obtains a specimen from the endometrium which may be studied carefully under the microscope. On several occasions carcinoma of the fundus has been reported by the pathologist when it was not suspected at the time the curettage was done.

The good end-results obtained by this method have been so well described by Clark and Norris,[2] Neill,[21] Stacy,[30] and others, that they need not be discussed here. Rarely more than one menstrual period appears after the treatment is given and it is followed by a complete cessation of all hemorrhage. The relative unimportance of the subjective symptoms of the artificial menopause in properly selected cases has been emphasized by me in a previous paper[16] and also by Corscaden.[4]

The treatment of hemorrhage in younger women is not such a simple matter. The surgeon usually does curettages at intervals which are likely to produce only temporary improvement. When the patient begins to tire of this form of treatment a hysterectomy is suggested. Heimann[13] has reported a few cases cured by the removal of small ovarian cysts. However, this operation is not always successful.

A large number of endocrine products have been recommended for the treatment of this condition but Graves[12] states, "We have never been successful in treating uterine hemorrhages with glandular preparations and have long since discarded them." The products most frequently recommended are corpus luteum, thyroid, pituitrin, mammary extract and sistomensin. Gordon and Cantarow[11] have reported success following the administration of parathyroid extract.

A few drugs such as ergot, stypticin hydrastis and iron tonics are still thought to have beneficial effects, though they are often disappointing when used alone. The elevation of blood calcium through the administration of calcium lactate is also looked upon favorably by some. Roe and Kahn[26] have shown that this drug, to be really effective, should be given in 5 gm. doses in aqueous solution at least half an hour before breakfast and at bedtime at least three hours after the last food is taken.

Preparations that are supposed to accelerate blood coagulation, such as fibrogen, coagulen, hemostatic serum, and so forth, may be helpful in an emergency. Ceanothin, a relatively inexpensive drug, is helpful at times and has the advantage of being effective when given orally. Of course, in the presence of severe hemorrhage serum injections or blood transfusions must be resorted to.

A number of plans for giving radiation to these patients have been proposed. The application of small doses of radium within the uterus is described by Clark and Norris,[2] and Neill.[22] Floris and Businco[7] report a series of patients definitely benefited by moderate doses of deep roentgen rays directed to the pituitary gland through the temples. Ford and Drips[9] have used light doses of deep roentgen rays over the ovaries in addition to the hypophyseal therapy with some success. Zaccaria[31] is enthusiastic over his results obtained by administering several series of small doses of roentgen rays to the spleen. Hubert[14] reports a group of patients treated by unilateral roentgen castration. The fact that in many instances he obtained a complete amenorrhea renders this method of doubtful value in the treatment of young women.

Although a great number of therapeutic measures have been set down it is well known that many of them have only a tem-

porary effect. Even the cases receiving radiation often have a recurrence of symptoms months or years after they are treated. It is therefore probably true, as E. Martin[17] contends, that these patients will remain well only when a permanent change can be brought about in the body metabolism. He advocates a change in the mode of living, a change of climate and general measures designed to improve general nutrition. A somewhat similar plan is evolved by Kermauner[15] who emphasizes the value of sunshine, fresh air and rest, along with an adequate diet and other general measures.

With such an ample armamentarium to draw on, we have evolved the following plan for the younger women, believing that a combination of the better methods should give the best results. The patient enters the hospital and receives the same preparation as the older patients previously described. A curettage is performed under gas anesthesia to bring about an immediate cessation of the hemorrhage. A small dose of heavily filtered intrauterine radium, usually 300 to 500 mg-hr., is then administered. On the following day one-third of an erythema dose of roentgen rays generated at 200 kv. and filtered through 0.75 mm. of copper and 1 mm. of aluminum is directed to the pituitary through 3 inch portals in each temple. After two days' rest in the hospital the patient goes home. She is asked to adhere to an anemia diet of the type previously described and is given a printed diet slip for guidance. She is also directed to take one dram of iron and ammonium citrate dissolved in a glass of milk after each meal for three to six weeks. The value of rest, fresh air, sunshine and proper exercise is emphasized. Sistomensin, gr. 1/5, is prescribed after each meal for four days preceding each menstrual period for three or four months. It can then be omitted unless menorrhagia reappears, in which event its use is resumed. If after leaving the hospital a real uterine hemorrhage should occur, she is directed to stay in bed with the foot of the bed elevated 8 inches, apply an ice bag to the pelvis and take 4 drams of ceanothin in water every two hours until the bleeding ceases. With such a plan the patient does not become excited or frightened and it is seldom necessary to insert a pack to control the hemorrhage.

A small group of young women suffering from hemorrhagia have been treated in this way, with a return of normal menstruation and good health in almost every instance. If, as sometimes happens, the menorrhagia recurs after six months or a year, the irradiation of the pituitary is repeated and the anemia diet and iron and sistomensin and general routine are started again. In most instances this plan has been very satisfactory. Intrauterine irradiation has been repeated in only 2 cases.

Small doses of intrauterine radium have been condemned by some because of the possible danger to future offspring. Murphy and Goldstein,[20] after studying 415 pregnancies in women who were subjected to radiotherapy prior to conception, state, "None of the children born of the women receiving exposures as low as 600 mg-hr. or less suffered any serious defects that could not be explained on grounds other than the irradiation." The careful observations of these investigators should offset much of the theorizing that has been based on fruit fly and mouse experimentation which is in no way applicable to human subjects.

SUMMARY

1. Chronic uterine hemorrhage occurring in women without demonstrable pelvic pathology is a common condition.

2. Experimental evidence and operative material indicate that the etiological factor is some abnormality of the endocrine system.

3. An artificial menopause produced by radiation therapy, coupled with an anemia diet and iron medication, brings about excellent results in women over forty years of age.

4. In younger women a return to normal health is usually obtained through a combination of a small dose of intrauterine

radium with roentgen irradiation of the pituitary, an anemia diet, an iron tonic, an improved mode of living and the administration of glandular products.

REFERENCES

1. Allen, E., and Doisy, E. A. An ovarian hormone; preliminary report on its localization, extraction and partial purification, and action in test animals. *J. Am. M. Ass.*, 1923, *81*, 819–821.
2. Clark, J. G., and Norris, C. C. Radium in Gynecology. J. B. Lippincott & Co., Philadelphia, 1927.
3. Corner, G. W., and Allen, W. M. Physiology of corpus luteum; production of special uterine reaction (progestational proliferation) by extracts of corpus luteum. *Am. J. Physiol.*, 1929, *88*, 326–339.
4. Corscaden, J. A. The radiotherapeutic menopause; its significance and management. *Am. J. Obst. & Gynec.*, 1926. *11*, 803–814.
5. Evans, H. M., and Long, J. A. The effect of feeding the anterior lobe of the hypophysis on the oestrous cycle of the rat; the effect of the anterior lobe administered intraperitoneally upon growth, maturity, and oestrous cycles of the rat. *Anat. Rec.*, 1921, *21*, 62.
6. Evans, H. M., and Simpson, Miriam E. Antagonism of growth and sex hormones of the anterior hypophysis. *J. Am. M. Ass.*, 1928, *91*, 1337–1338.
7. Floris, M., and Businco, O. Roentgen therapy of the pituitary in alterations of the menstrual function. *Radiol. med.*, 1929, *16*, 474–492.
8. Fluhmann, C. F. The significance of anterior pituitary hormone in the blood of gynecologic patients. *Am. J. Obst. & Gynec.*, 1930, *20*, 1–15.
9. Ford, F. A., and Drips, D. G. Clinical and experimental studies of low dosage irradiation of the ovaries and hypophysis in menstrual disorders. *Radiology*, 1929, *12*, 3–11.
10. Frank, R. T. The Female Sex Hormone. Charles C. Thomas, Springfield, Ill., 1929.
11. Gordon, B., and Cantarow, A. The use of parathyroid extract in hemorrhage. *J. Am. M. Ass.*, 1927, *88*, 1301–1302.
12. Graves, W. P. Ovarian therapy. *J. Am. M. Ass.*, 1927, *89*, 1308–1311.
13. Heimann, Fritz. Erfahrungen über Menstruationsstörungen bei Ovarialerkrankungen. *Med. Klin.*, 1928, *24*, 1111–1114.
14. Hubert, R. The question of unilateral roentgen castration. *Strahlentherapie*, 1929, *32*, 303–308.
15. Kermauner, Fritz. Genitalblutungen junger Mädchen. *Wien. klin. Wchnschr.*, 1929, *42*, 297–298.
16. Martin, C. L. Radiation therapy in benign uterine hemorrhage. *Texas State J. M.*, 1928, *24*, 280–285.
17. Martin, E. The treatment of endocrine disturbances during menstruation. *Deutsche med. Wchnschr.*, 1928, *54*, 989–990.
18. Meigs, J. V. Uterine bleeding; an analysis of cases seen in the tumor clinic of the Massachusetts General Hospital. *New England J. M.*, 1929, *201*, 525–530.
19. Meigs, J. V. Benign uterine bleeding; a preliminary report. *Am. J. Obst. & Gynec.*, 1927, *14*, 225–231.
20. Murphy, D. P., and Goldstein, L. Etiology of the ill health of children born after maternal pelvic irradiation. I. Unhealthy children born after preconception pelvic irradiation. Am. J. Roentgenol. & Rad. Therapy, 1929, *22*, 207–219.
21. Neill, Wm., Jr. Radium in the treatment of menopausal hemorrhage without demonstrable lesion. *J. Am. M. Ass.*, 1927, *88*, 1867–1868.
22. Neill, Wm., Jr. The treatment of uncontrollable adolescent bleeding with radium. Am. J. Roentgenol. & Rad. Therapy, 1927, *17*, 461–463.
23. Novak, E. Menstruation and Its Disorders, 1924.
24. Novak, E. Diagnostic curettage in so-called idiopathic uterine bleeding. *N. York State J. M.*, 1925, *25*, 961–964.
25. Novak, E., and Martzloff, K. H. Hyperplasia of the endometrium; a clinical and pathological study. *Am. J. Obst. & Gynec.*, 1924, *8*, 385–411.
26. Roe, J. H., and Kahn, B. S. Absorption of calcium from the intestinal tract of human subjects; influence of foods. *J. Am. M. Ass.*, 1927, *88*, 980–984.
27. Schröder, Robert. Beiträge zur normalen und pathologischen Anatomie des Endometriums. *Arch. f. Gynäk.*, 1912, *98*, 81–135.
28. Shaw, Wilfred. Irregular uterine hemorrhage. *J. Obst. & Gynaec. Brit. Emp.*, 1929, *36*, 1–69.
29. Smith, P. E., and Engle, E. T. Experimental evidence regarding rôle of anterior pituitary in development and regulation of genital system. *Am. J. Anat.*, 1927, *40*, 159–217.
30. Stacy, Leda J. Radium treatment in 600 cases of menorrhagia. Am. J. Roentgenol., 1920, *7*, 379–382.
31. Zaccaria, A. The roentgen irradiation of the spleen in metrorrhagias of puberty. *Radiol. med.*, 1928, *15*, 169–174.
32. Zondek, B., and Aschheim, S. Hypophysenvorderlappen und Ovarium Beziehungen der endokrinen Drüsen zur Ovarialfunktion. *Arch. f. Gynäk.*, 1927, *130*, 1–45.

DISCUSSION

Dr. David Y. Keith, Louisville, Ky. I am sure we have all enjoyed Dr. Martin's discussion of uterine hemorrhage. He has brought before us not only a radiation problem, but a gynecological one. I shall not discuss the gynecological side because it is entirely theoretical and probably all of us have different ideas.

As to the dosage, we have treated very few patients by using x-ray over the pituitary and in the ones we have treated, we have seen no benefit derived. As to dosage in patients above forty years of age, we usually give a little larger dose of irradiation than he gives and do not use roentgen radiation. From an experience over a period of ten years in the use of radium, we see no reason for changing from the results he has shown here.

We would like to emphasize a point about the dosage for the young girl, particularly under twenty years of age and for young women. Dr. Martin referred to dosage here from 300 to 500 milligram-hours.

Some nine or ten years ago, through the fault of a clock in the hospital, we gave a small dose (approximately 47 mg-hr.) to a young patient, who had been bleeding almost constantly for a period of three and one-half years, and we obtained a cure from this small dosage. Before that time we had been giving doses, as Dr. Martin suggests, of usually 300 to 400 or 500 mg-hr., never going above 500 mg-hr. After this experience we lowered our dosage and rarely do we now give more than 200 mg-hr. to young patients.

Out of a series of some 15 or 16 cases in girls under twenty years of age none of whom received more than 300 mg-hr. and most of them 200 mg-hr., basing the dosage entirely on the type of menstruation and the age it first appeared, we have had to repeat the treatment in only two cases.

As to the patients over forty years of age, the greatest trouble, of course, from a gynecological standpoint, is the diagnosis. In these cases we must be accurate in the diagnosis. I would like to say one thing which the gynecologists say a great deal about, and that is the danger of using radium in these patients, particularly where inflammatory diseases of the adnexa are present. I do not believe that radium introduced intrauterinely accounts for the few deaths that have been reported and the inflammatory changes that are supposed to be excited from the radiation. If this were true, a radium pack over the pelvis or roentgen therapy in these cases would give the same thing. In my opinion, the entire lighting-up of the pelvic inflammatory disturbance is due to trauma, due to a vigorous curettement. Under anesthesia the uterus is pulled downward and vigorously curetted and nature's protective wall is broken down. I am sure those patients would have a lighting-up of the inflammation if no radium had been applied.

I would also like to emphasize what Dr. Martin has said in regard to anesthesia. In 8 or 9 cases out of every 10 we treat, certainly in more than 75 per cent of the cases, we do not give any anesthetic. The curettement can be done under sodium amytal, as he suggests. It can be done under morphine, or under some of the intravenous methods of sodium amytal, or by oral adminisration of sodium amytal, preferably one hour before operation. From a gentle curettement, a satisfactory specimen can be obtained, and the patient is put to bed and she will not have the nausea she experiences after having had an anesthetic and a foreign body inserted in the uterus. If a low grade pelvic inflammation is present a gentle curettage and gentle handling of the uterus will not cause the infection to become active.

Dr. Martin (closing). I have nothing further to say except that I do not feel that it is necessary for us to completely divorce ourselves from the field of gynecology. The gynecological part of this work is not difficult and the end-results are very much more satisfactory when the radiologist who gives the treatment can carefully examine his patient before and after the irradiation is administered.

Dr. Keith spoke of the technique of curettement and I think he raised an important point. In most hospitals this procedure necessitates a long anesthesia, the service of a surgeon and one or more assistants and more or less rough handling of the cervix and uterus. With a bivalve speculum and hegar dilators the cervix may be gently dilated, a curettage done and radium packed in place in about ten minutes. A head mirror gives excellent illumination and makes it unnecessary to pull the cervix downwards with forceps. When this procedure is carried out rapidly and with a minimum of roughness the patient hardly realizes that anything has been done.

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THE RESULTS OF TREATMENT OF CARCINOMA OF THE CERVIX

BASED ON A STUDY OF 417 CASES—JANUARY, 1919 TO JUNE, 1925.*

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CANCER of the cervix is fairly common as evidenced by the records of the State Institute for the Study of Malignant Disease which show that 16 per cent of all patients admitted were suffering from this type of malignancy.

The symptomatology of *early* cancer of the cervix uteri is not pathognomonic and only the careful routine pelvic examination, together with education of the laity, can possibly bring this type of case to treatment in its early stage.

Among the 417 cases of cervical cancer which were available for study, only 57 cases, or 13.6 per cent, could be considered operable. The operative mortality as given in various surgical statistics varies from 15 to 20 per cent. The five year end-results as well as the mortality following Wertheim's operation vary within wide limits in the hands of different gynecologists. Berkeley's[1] statistics recently published, giving 36.8 per cent clinically well after five years, are very exceptional as compared with results from other clinics.

As stated above, only 13.6 per cent of the 417 cases studied were considered operable, leaving a remainder of 86.4 per cent for whom some other form of treatment had to be attempted. We believe the method of choice in these cases to be irradiation with both roentgen rays and radium. With few exceptions all cases have been accepted for treatment at the Institute and an attempt has been made to eradicate the disease or to give some palliation even in the far-advanced Group IV cases. In the Group V cases the treatment was carried out to the best of our ability, though often done under great difficulty due to previous operations.

Numerous papers giving the five year end-results of treatment of cancer of the cervix uteri have appeared recently. In these reports various classifications, such as operable, borderline, and inoperable, were followed, in the interpretation of which the personal equation enters to a considerable degree. However, classification by groups is essential to a thorough understanding of what is, or can be, accomplished by means of irradiation. It is only fair to say that as one gains in experience the classification will be on a sounder basis. With the improvement in the technique since 1926 the cures as given here should be greatly augmented.

Viewing a group of cases such as this from the standpoint of "clinically well five years or more" does not give an exact picture of the great benefits and comfort which many patients derived, even though the disease was not eradicated, but irradiation was only the means of prolongation of life in a palliative way.

We have divided these 417 cases according to the anatomical involvement as suggested by Schmitz,[5] into five groups:

Group I—Where the lesion is confined entirely to the cervix.

Group II—Where the lesion involves the cervix, extending to the vaginal mucous membrane, without definite infiltration of the broad ligament areas.

Group III—Where there is a lesion of the cervix, with or without extension to the vaginal mucous membrane, but with beginning involvement of one or both broad ligament areas; the uterus, however, being somewhat movable.

Group IV—Where the lesion originates in the cervix, with or without extension to the vaginal mucous membrane, or with distant metastases, and with fixation of the uterus.

* Read at the Fifteenth Annual Meeting, American Radium Society, Detroit, Mich., June 23–24, 1930.

Group v—Recurring cancer of the cervix, following operation.

A correct anatomical classification is difficult due to the fact that early lesions of the cervix may have metastasized through the lymph-bearing areas but present no clinical evidence, and that inflammatory reactions of the parametrium may be mistaken for evidence of the disease. The malignancy index, as derived from the histological picture, is of some importance in prognosis. The work of Martzloff,[4] Schmitz and Hueper,[6] Broders,[2] Healy[3] and others, has done much to intensify a scientific interest as to the ultimate prognosis. As one of us has said in a previous paper,[7] it seems that in calculating indices of malignancy from biopsy material only an average may be obtained, and that, in order to draw definite conclusions, one should have the whole tumor for such histological study since the picture may vary in different parts of the same tumor.

In this group of cases the youngest patient was twenty-three and the oldest eighty-three years of age (see Table I). Four hundred and five of these women were married. One to 18 pregnancies were recorded in 368 cases, the most frequent being 2, 3, and 4 (see Table II). Of the total of 1,685 pregnancies, 1,412 were full term; 273 were miscarriages, abortions, or premature births; 12 of the women suffering from this disease were unmarried. A history of cancer in the family was given by 88 of these patients. Blood Wassermann and Kahn reactions were positive in 54 cases, noticeably in the younger patients. The symptoms which were noted were intermenstrual bleeding, prolonged menstrual bleeding, watery or brownish discharge, and in far-advanced cases, pain,

TABLE I

AGE INCIDENCE AT THE TIME OF ADMISSION

Group	Age							
	20–24	25–29	30–39	40–49	50–59	60–69	70–79	80–89
I	—	1	3	7	2	4	—	—
II	—	1	4	9	16	10	—	—
III	1	3	23	46	35	16	6	1
IV	—	2	33	57	57	26	7	1
V	1	3	13	11	14	4	—	—
Total	2	10	76	130	124	60	13	2

TABLE II

SHOWING NUMBER OF CASES REPORTING PREGNANCIES, NUMBER OF TIMES, GROUP BY GROUP

Group	Number of Pregnancies																		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I	1	4	2	2	2	1	2	1	1	—	—	—	1	—	—	—	—	—	1
II	6	3	7	5	6	3	2	3	—	1	1	2	1	—	—	—	—	—	—
III	15	14	15	22	19	10	6	9	6	5	2	4	—	1	1	1	—	—	—
IV	23	21	25	18	22	17	11	16	10	7	4	—	6	1	—	1	—	1	—
V	4	9	7	11	3	2	5	4	1	—	—	—	—	—	—	—	—	—	—
Total	49	51	56	58	52	33	26	33	18	13	7	6	8	2	1	2	—	1	1

which was due to invasion of the surrounding tissues.

TREATMENT

For a proper evaluation of any given treatment, it is essential that at least five years shall have passed since the last treatment, and that, where possible, the observations in the follow-up be made by the one who has treated the case.

The method of treatment of cervical cancer with roentgen rays and radium was uniform from 1919 to June, 1925. This was accomplished with the least possible amount of disturbance and trauma to the patient. When these patients applied at the Institute for treatment a complete history was obtained, physical examination, blood and urine examinations were made, and in Groups III and IV, urologic examinations, when indicated. They were then put to bed and hot, cleansing, prolonged, douches were given once or twice daily. On the day of admission, a roentgen treatment was given, the dose being 25 per cent at 10 cm. depth. The following day they were given a hypodermic of 1/4 to 1/6 grain of morphine one-half hour before the radium was given. In the operating room, under nitrous oxide and oxygen anesthesia, the patient was placed in the lithotomy position, draped with sterile linen and the vagina was cleansed as thoroughly as possible by the use of a 4 per cent chlorine gas in water. The cervical os was then located by the use of a small probe or sound and the cervix was gradually dilated so that tandem tubes could be inserted with little or no difficulty. At this time a section of the cervix was obtained for microscopic examination. Then the tubes were inserted up to the internal orifice or as near this as possible, and left in position for 1200 mc-hr. per tube. The tubes together measured 5 cm. in length and the walls consisted of 0.5 mm. gold, 0.5 mm. brass, and 1 mm. rubber over the entire tube. No other radium application was made in or against the cervix. The vagina was packed with tampons of tightly wound absorbent cotton, soaked in alboline, two being inserted behind the cervix, one laterally on either side, and one anteriorly. The remainder of the vagina was then packed in an effort to keep the bladder and rectal walls as far as possible from the source of radiation. On the following day the tampons and tandem tubes were removed and a cleansing douche given. If the patient had no rise in temperature or other contraindication, she was subjected to further high voltage roentgen treatments, the dose being equally divided between the front and the back. Allowing for the number of days during which the treatment was carried out, this varying from three to five days, and estimating that 4 per cent of the total radiation from the tubes reached a point 5 cm. out, sufficient radiation was given to bring the amount up to 130 to 140 per cent of the skin erythema dose. The roentgen-ray factors were: 200,000 volts; 8 ma.; distance, 80 cm.; filter, 0.5 mm. Cu and 1 mm. Al; field, 20×20 cm. The patients were confined to the hospital for from four to seven days; then, if their temperatures were normal, they were permitted to go home with instructions as to diet, rest, the use of iron and arsenic medication, and cleansing douches. These patients were examined once a month the first year, every two months the second, every three months the third, and thereafter every four to six months. Further irradiation was not given within three months and then only if there was evidence of local activity. At this time, for palliative reasons, radium tubes were again inserted, sometimes supplemented by high voltage roentgen treatment. Usually one treatment was sufficient. Occasionally two or even three were given. No patient was refused the benefit of irradiation except those who were practically moribund.

Reactions attributable to this procedure varied in individual cases, but on the whole were satisfactory. Usually these patients showed definite signs of improvement in general feeling and regression of the tumor within three to four weeks after radiation treatment. All discharge frequently sub-

sided in from four to eight weeks, though in some cases a watery or brownish discharge persisted over a longer period of time.

Fistulae, rectovaginal or vesicovaginal, occurred in 37 instances; 26 of these were in Groups IV and V; 8, in Group III; 2, in Group II; and one, in Group I. The formation of fistulae is due to the devitalization of the tissue and subsequent irradiation, as well as to the extension of the disease toward the rectal and bladder walls. As a rule, it is seen in the far-advanced cases which probably would have developed fistulae from the disease. It has been our misfortune, in a few instances, to have fistulae appear as late as six months to a year after re-irradiation. On two occasions we have seen bladder fistulae heal spontaneously and remain healed and free from disease for from one to three years after the fistula formation.

Since 1926 we have supplemented the treatment outlined above by the implantation of gold seeds of emanation and we feel that this has given marked improvement in our results since that time.

RESULTS OF TREATMENT

In Group I there were 17 cases. One was lost track of after being clinically well 2½ years, but we have reason to believe that she is still alive and well over 5 years.

Sixteen cases are available for study.

10, or 62.5 per cent, have been clinically well 5 years or more.

6 died from the disease as follows:

1 in 5 to 6 years from recurrence, having been clinically well 4 years;
3 in from 1 to 2 years;
2 in less than 1 year.

In Group II there were 40 cases. Four died from intercurrent disease; no evidence of malignancy in one for 4 years, in another for 2 years and in 2 for 1 year.

Thirty-six cases are available for study.

10, or 27.7 per cent, have been clinically well 5 years or more.

26 died from the disease as follows:

6 in from 2 to 3 years;
8 in from 1 to 2 years;
12 in less than a year.

In Group III there were 131 cases. Two died from intercurrent disease—1 in 5 months; 1 in 3 years; no evidence of malignancy was noted at the time of death.

One hundred and twenty-nine cases are available for study.

17, or 13.2 per cent, have been clinically well 5 years or more.

112 died from the disease as follows:

1 in from 5 to 6 years;
4 in from 4 to 5 years;
13 in from 2 to 3 years;
16 in from 1 to 2 years;
72 in less than 1 year.

In Group IV there were 183 cases. Two died in 1 year from intercurrent disease, no evidence of malignancy being present.

One hundred and eighty-one cases are available for study.

2, or 1.1 per cent, have been clinically well 5 years or more.

179 died from the disease:

1 in from 5 to 6 years;
1 in from 4 to 5 years;
5 in from 2 to 3 years;
28 in from 1 to 2 years;
144 in less than 1 year.

In Group V there were 46 cases available for study.

3, or 6.5 per cent, are clinically well for 5 years or more.

43 died from the disease:

1 in from 4 to 5 years;
1 in from 3 to 4 years;
7 in from 1 to 2 years;
34 in less than a year.

CONCLUSIONS

1. Irradiation in the treatment of cancer of the cervix uteri gave the following results:

Group I—62.5 per cent clinically well 5 years or more

Group II—27.7 per cent clinically well 5 years or more

Group III—13.2 per cent clinically well 5 years or more

Group IV—1.1 per cent clinically well 5 years or more

Group V—6.5 per cent clinically well 5 years or more.

2. Combining Groups I and II, which were the operable cases, 20 out of 52, or 38.4 per cent, have been clinically well five years or more.

3. Groups I, II, and III, in which at the time of admission it was thought possible

to effect a cure, resulted in 37 out of 181, or 20.4 per cent, being clinically well five years or more.

4. The primary mortality was less than 1 per cent, including all cases.

5. Twelve patients died in from one to four years from intercurrent disease, there being no evidence of recurrence of the cancer.

6. No other treatment could possibly have given the palliative results which were obtained in many of the remainder of the cases.

7. Fistulae occurred 26 times in the far-advanced cases in which re-irradiation was deemed advisable and this should be borne in mind in the re-treatment of such cases.

8. Two bladder fistulae, which developed, healed spontaneously.

9. We believe that radiation treatment in cancer of the cervix is the method of choice. The improvement in technique since 1926 gives promise of a better percentage of five year cures in the early as well as in the more advanced cases.*

* For discussion see page 370.

REFERENCES

1. Berkeley, Comyns. The results of radical operation for carcinoma of the cervix uteri. Report of the International Conference on Cancer, London, July, 1928. John Wright & Sons, Ltd., Bristol, England, p. 94.
2. Broders, A. C. Carcinoma, grading and practical application. *Arch. Path. & Lab. Med.*, 1926, *2*, 376–381.
3. Healy, W. P. Variation in radiosensitivity of epidermoid carcinoma of the cervix uteri. *Radiology*, 1929, *13*, 323–325.
4. Martzloff, K. H. Carcinoma of the cervix uteri; a pathological and clinical study with particular reference to the relative malignancy of the neoplastic process as indicated by the predominant type of cancer. *Johns Hopkins Hosp. Bull.* 1923, *34*, 141.
5. Schmitz, Henry. The classification of uterine carcinoma for the study of the efficacy of radium therapy. Am. J. Roentgenol., 1920, *7*, 383–395.
6. Schmitz, H., and Hueper, W. C. The prognostic value of the histological malignancy index and the clinical grouping of carcinomata of the uterine cervix. *Radiology*, 1928, *11*, 361–369.
7. Schreiner, Bernard F., and Simpson, B. T. End-results of radium treatment in epithelioma of the cervix uteri based on a study of 374 cases. *Radiol. Rev.*, 1929, *51*, 141–147.

THE TECHNIQUE OF RADIUM AND ROENTGEN TREATMENT OF CARCINOMA OF THE UTERUS*

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THE combined technique of radium and roentgen radiation in the treatment of carcinoma has been in continuous use in our clinic since 1914. Four distinct periods were observed. Each period was characterized by an increase in the combined radiation tissue dose and a corresponding improvement in the five year end-results. It becomes more and more obvious from the reports in the literature and our own observations that the radiation dose applied to cancer, termed the "tissue dose" should be increased by every means at our command in order to "kill" the cancer cells and to improve the five year end-results. The development of the technique in our clinic to further this end will be described in the following paragraphs.

If the statistics on the five year good end-results of radiation treatment in uterine carcinoma are perused, then the conclusion may be drawn that the extent of the growth and the grade of histological malignancy influence the good end-results. Should the tumor extend beyond a certain distance from the radium capsule which has been placed intrauterinely, then such tissue receives a sublethal radiation dose and the tumor tissue beyond this distance continues to grow, just as vestiges of a cancer left behind after an incomplete surgical operation continue to grow. The area of effective irradiation may be perceptibly larger in highly radiosensitive cancers and very small in radioresistant growths. Obviously sublethal doses of radiation applied to the parametria and regional lymph nodes explain the unfavorable results obtained with irradiation in these extensive cancers. If a lethal cancer dose could be applied to the entire tumor-bearing area then results of radiation treatment should become markedly better.

The questions then arise: (1) Can a radiation dose be determined which is lethal for uterine carcinoma, and (2) if such a dose exists, how may it be applied homogeneously to the entire tumor-bearing area that is, the true pelvic cavity, without severe latent damages to the normal tissues within the radiation field?

THE LETHAL RADIATION DOSE FOR CARCINOMA OF THE UTERUS

The lethal radiation dose for carcinoma and sarcoma has been determined by Wood and Prime in animal experimentations. From these they concluded that the approximate radiation dose necessary to kill all the cells of a rapidly growing, very cellular and highly malignant sarcoma or carcinoma in man, is between 5 and 7 skin erythema doses of filtered roentgen rays. Ewing states that in general the degree of radiosensitivity runs parallel with the degree of anaplasia of tumor cells. In the group of glandular tumors one may recognize several grades of malignancy: adenoma malignum, adenocarcinoma, alveolar carcinoma, and diffuse adenocarcinoma, the sensitivity increasing in the order named. Among epidermoid carcinomas the adult squamous tumors are resistant, basal cell varieties are more sensitive, while transitional cell carcinomas and lympho-epitheliomas are highly sensitive. However, the cell type alone does not govern the degree of histological malignancy and radiosensitivity as the degrees of anaplasia and differentiation and undifferentiation undoubtedly influence the malignancy index and, therefore, radiosensitivity.

* Read at the Fifteenth Annual Meeting, American Radium Society, Detroit, Mich., June 23–24, 1930.

Martin and Quimby reported 10 cases of malignant intraoral tumors of various cell types. They found the lethal or superlethal tissue dose for squamous cell carcinoma to be about 10 S.E.D., and for transitional cell carcinoma to be about 2.5 S.E.D.

Similar observations were reported by the writer on 135 cases of cervical carcinoma. Of this group 108, or 80 per cent, were primary solid carcinomas, and 27, or 20 per cent, glandular carcinomas. Among the former were seen: spinous cell carcinoma with cornification, 4, or 3.71 per cent; spinous cell carcinoma without cornification, 36, or 33.33 per cent; round or transitional cell carcinoma, 48, or 44.44 per cent; and spindle or basal cell carcinoma, 20, or 18.52 per cent. Among the tubular or glandular carcinomas were observed: malignant adenoma, 1, or 3.72 per cent; papillary and gelatinous adenocarcinoma, 8, or 29.62 per cent; adenocarcinoma 12, or 44.44 per cent; and solid adenocarcinoma, 6, or 22.22 per cent.

Without relating any details, as they may be perused in the publications mentioned, clinical observations seem to show that the lethal radiation dose for squamous cell cancer of the cervix is probably 4 to 5 S.E.D.; of transitional and basal cell cancer, 2 to 2.5 S.E.D. The glandular carcinomas respond apparently to the same lethal doses, *i.e.*, malignant adenoma and papillary adenocarcinoma to 4 to 5 S.E.D. and adenocarcinoma and solid diffuse adenocarcinoma to about 2.5 S.E.D.

Great interest should be attached to the radiosensitivity of normal epithelial tissue lying within the radiation fields. Can it recover from the effect of the radiation if 4 S.E.D. has been applied? The skin will recover from the exposure of 2 to 2.5 S.E.D. with very mild latent changes if the threshold skin erythema dose is, according to

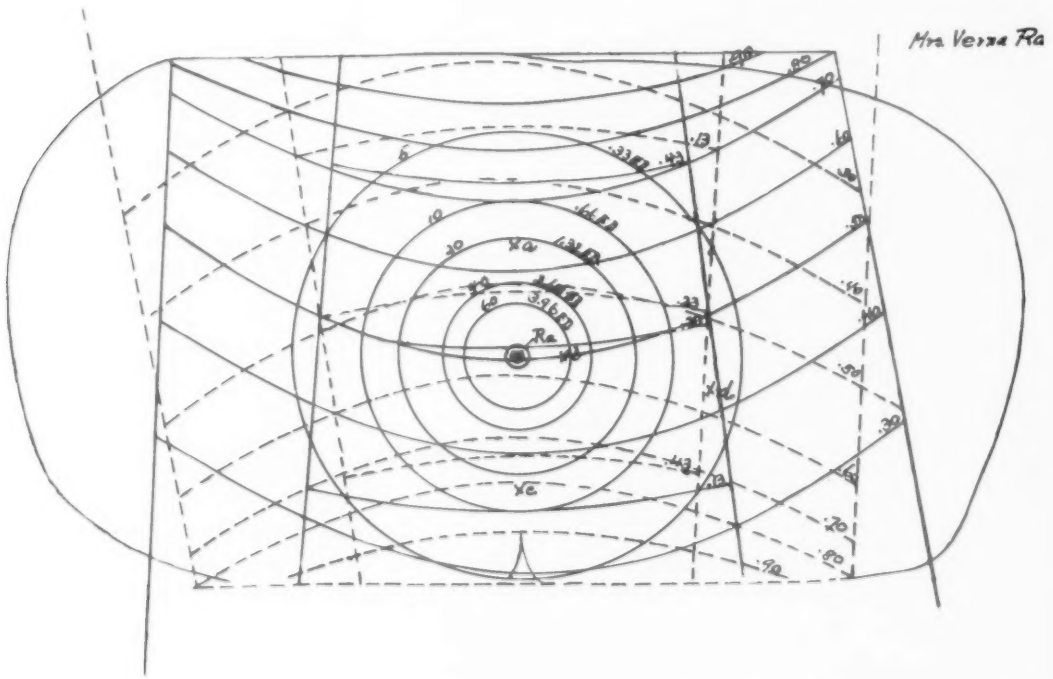

FIG. 1. Transverse section of a pelvis with the equal intensity curves of: (1) the radium capsule placed intracervically; (2) roentgen rays produced with 211 kv., 65 cm. focal skin distance, 0.75 mm. copper and 1.0 mm. aluminum filter and a port of entry 15×20 cm., and (3) the radium cannon with a port of entry of 10 cm. diameter, 2 mm. brass filter and 10 cm. focal skin distance. Point "*a*" indicates location of posterior bladder wall; point "*b*" of lateral vaginal fornix; point "*c*" of anterior rectal wall, and point "*d*" of the lateral bony pelvic wall.

Martin and Quimby, that dose which in 80 per cent of the cases treated produces a faint reddening or bronzing of the skin in from ten to twenty days, and in the other 20 per cent produces no visible effect. The

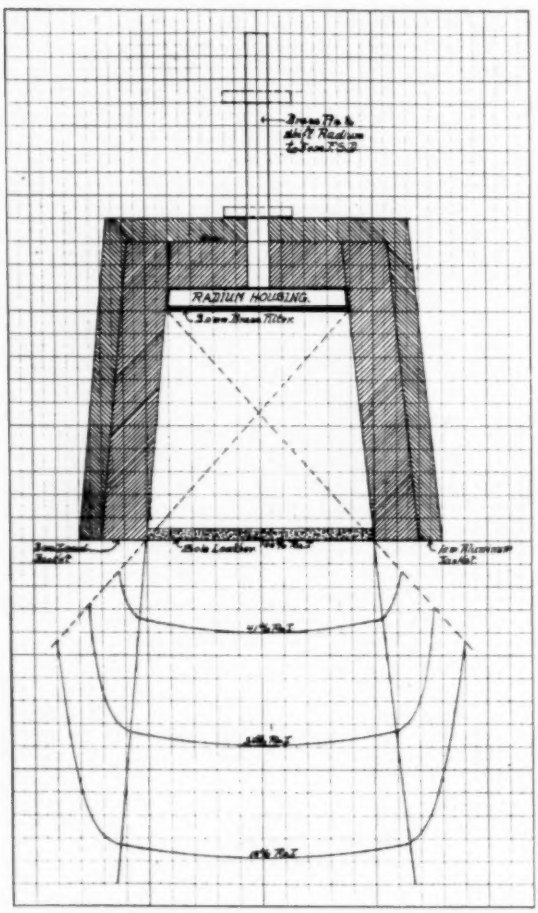

Fig. 2. Radium cannon with equal intensity curves at 5, 10 and 15 cm., as determined by Failla and Quimby.

mucosa of the urinary bladder is constructed of transitional and basal celled epithelium. This explains the high radiosensitivity of this tissue. It is expressed in the intense radiation cystitis so frequently seen in this organ after irradiation, and in the rapid resorption of such cancers after comparatively small radiation doses. The rectal glandular mucosa appears to be much more resistant to irradiation and probably may be exposed to 4 s.e.d. with few latent changes. Pfahler and Widmann and Cutler and Quick report their observations with combined applications of radium and roentgen rays and state that the surface epithelium of the skin will recover from the effects of 2 to 2.5 s.e.d.

The conclusion may be drawn that the lethal radiation dose of a prickle cell cancer, malignant adenoma and papillary adenocarcinoma is probably 4 to 5 s.e.d. and for round and spindle cell cancers and typical and solid adenocarcinoma 2 to 2.5 s.e.d. The normal skin will permanently recover from the combined application of 2 to 2.5 s.e.d. of radium and roentgen rays.

The Technique of the Combined Radium and Roentgen Treatment of the Cervix

Figure 1 pictures the method and a study of it is self-explanatory. The radiations are applied intrauterinely with radium and externally with short wave roentgen rays and radium. The latter is contained in a cannon, the structure of which is shown in Figure 2.

The intrauterine radium dose is 4500–4800 milligram-element-hours and is obtained by three insertions of thirty to thirty-six hours each at eight day intervals. This technique has not been changed since 1914. The amount of radium is 50 mg. element placed in two silver capsules about 1.5 cm. long, with a wall thickness of 0.5 mm. The filter is 1.5 mm. brass. The secondary beta rays are arrested by a rubber filter 2.5 mm. thick. The first insertion is done under gas anesthesia. This permits a thorough rectal palpation of the parametria and the regional lymph nodes. Tissue for microscopic examination is removed at this time.

The factors for roentgen treatment of the first period, 1914 to 1919, were: 110 kv. maximum; standard Coolidge tube with broad focus; fields, 5 cm. square; target skin distance, 25 cm; filter 6 mm. aluminum; number of fields 10 to 20; time duration of application to each field 150 ma-min.; duration of application 14 to 20 days.

The depth dose at 10 cm. measured in the water phantom is about 20 per cent of the surface intensity.

The factors for roentgen treatment of the second period, 1920 and 1921, were: 140 kv. maximum; standard Coolidge tube with broad focus; filter, 0.5 mm. copper plus 1.0 mm. aluminum; target skin distance, 65 cm; size of fields, 20 cm. square; number of fields, 2 to 4; time duration to each field 1000 ma-min. in one sitting. The depth dose at 10 cm. measured in the water phantom is about 48 per cent of the surface intensity. The skin dose is 1.5 S.E.D. to each field if 1 S.E.D. represents the dose defined by Martin and Quimby.

TABLE I

COMBINED INTENSITIES IN TRANSVERSE PLANE AND MEDIAN PLANE
With the Combined Technique of Radium and Roentgen Rays in Per Cent of the Skin Erythema Dose.

	Transverse Plane Per Cent in S.E.D.	Median Plane Per Cent in S.E.D.
Bladder at *a*		
Radium capsule	200	200
Radium cannon	48	46
X-rays	150	145
Total	398	391
Lateral uterine wall at *b*		
Radium capsule	600	
Radium cannon	46	
X-rays	144	
Total	790	
Rectum at *c*		
Radium capsule	200	200
Radium cannon	45	45
X-rays	172	170
Total	417	415
Regional lymph nodes at *d*		
Radium capsule	75	75
Radium cannon	46	46
X-rays	152	140
Total	273	261

tance, 65 cm; size of fields, 15 cm. square; number of fields, 2 to 3; time duration of application to each field 1050 ma-min.; duration of application 3 to 6 days. The depth dose at 10 cm. measured in the water phantom is about 35 per cent of the surface intensity.

The factors for roentgen treatment of the third period, since 1922, are: 211 kv. maximum; large size water-cooled Coolidge treatment tube; filter, 0.75 mm. copper plus 1.0 mm. aluminum; target skin distance, 65 cm; size of fields, 20 cm. square; number of fields, 2 to 4; time duration to each field 1000 ma-min. in one sitting. The depth dose at 10 cm. measured in the water phantom is about 48 per cent of the surface intensity. The skin dose is 1.5 S.E.D. to each field if 1 S.E.D. represents the dose defined by Martin and Quimby.

Since 1928, the fourth period, radium applications at a distance were added. The construction of the "radium cannon" is seen in Figure 2. The diameter of the port of entry is 10 cm. The threshold erythema dose is obtained with 24 gm-el-hr. if applied in one sitting and with 32 gm-el-hr. if applied within eight days.

The total radiations at points *a*, *b*, *c* and *d* in Figure 1 representing the transverse plane, and in the median sagittal planes received from the intrauterine radium cap-

sule, the anterior and posterior roentgen fields, and the anterior and posterior radium cannon fields are as follows (see Fig. 1 and Table 1).

DISCUSSION

At isodose 20, which is 3 cm. distant from the radium capsule, the highest radiation dose in patients with a pelvis having an anteroposterior diameter of 20 cm. is 3.75 to 4 s.e.d.; at isodose 10, which is 5 cm. distant from the radium capsule, the tissue dose will be 3.0 to 3.7 s.e.d.; at isodose 5, which is about 6.5 cm. distant, the tissue dose will be 3.25 to 3.5 s.e.d. Should the tumors react to the lethal doses given in the preceding paragraphs, it follows that squamous cell carcinoma may be success-

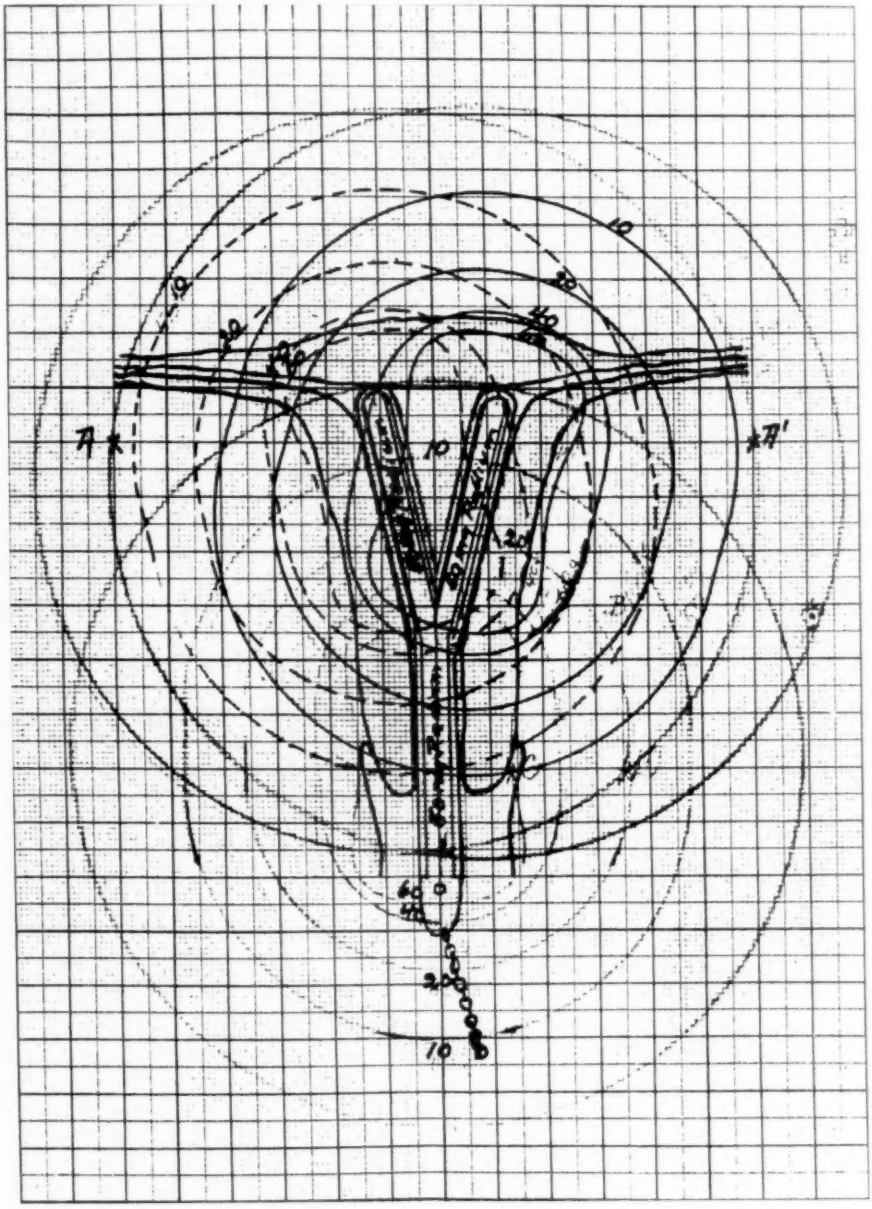

Fig. 3. Y-shaped brass filter for the treatment of cancer of the body of the uterus.

fully treated if it does not extend beyond a radius of 3 cm. beyond the radium capsule, while round and spindle cell carcinomas extending to a radius of 6.5 cm. may be arrested by this method in the majority of cases. The squamous cell cancers of Groups 1 and 2 in our series had good end-results in about 40 per cent; and the round cell carcinomas of Groups 1, 2 and 3 had good end-results in 54.54 per cent, while the basal cell carcinomas of Groups 1, 2 and 3 had a good end-result in 13.5 per cent. Therefore the good end-results confirm the observations of Ewing that round cell cancers are highly radiosensitive.

RADIUM TECHNIQUE IN CARCINOMA OF THE BODY OF THE UTERUS

It is apparent from the study of the distribution of the equal intensity curves that the skin erythema dose attained at a distance of 1.25 cm. (that is, isodose 40) from the center of the cervical canal, which is also the central axis of the radium capsule, is 4 S.E.D., and at a distance of 2.5 cm. (that is, equal intensity curve 10) it is only 1 S.E.D. with a 4800 mg-el-hr. radium application. Therefore within a distance of 1.25 cm. the loss of intensity due to dispersion has been 75 per cent.

The uterine cavity across the fundus is on an average 3 cm. This width may become markedly increased especially when a proliferating or everting mucous membrane carcinoma is present. A radium capsule inserted into the uterine cavity may and does shift is position as much as 2.75 cm. and hence the radium intensity applied to one cornu may be only 25 per cent of that attained at the opposite angle. Furthermore, the lateral uterine wall is about 2 cm. in thickness. It is more than 2 cm. if an infiltrating endophytic wall carcinoma is present. Such a carcinoma may infiltrate the entire wall and the lethal tissue dose must be calculated for the circumference of the organ which is about 6 cm. from outer horn to outer horn. If the radium filter capsule slips into one uterine cornu then the opposite inner angle is 2.5 cm. distant and receives only 1 S.E.D. The opposite outer cornu lies at least 3.75 cm. distant, that is, at isodose 5 and receives about 0.5 S.E.D. The inhomogeneous distribution is one of the chief reasons for the poor end-results obtained with radium applications in corpus carcinomas.

We use a Y-shaped applicator as shown in Figure 3. Thereby the distribution of radiation intensities will be relatively homogeneous. The applicator is constructed on the principle of an obstetrical forceps, the vertical arm being cut in halves. After dilatation of the cervical canal the left arm filled with 50 mg. radium element and then the other arm filled with 50 mg. radium are inserted. The two halves of the vertical arm are placed in apposition and thus held with an acutely curved forceps with rounded broad blades that surround the arm firmly. A cuff is slipped over which maintains the two halves permanently in this position. The vertical arm can also hold 50 mg. radium element. Finally a cap is screwed in to which a small chain is attached. The vagina is packed firmly with gauze to remove the posterior bladder and anterior rectal mucosa as far away as possible from the radium carrier.

The distribution of the radium intensities may be calculated from Figure 3 and from the following table:

TABLE II

DISTRIBUTION OF S.E.D. WITH 4800 AND 3200 MG-EL-HR. RADIUM APPLICATIONS. FILTER 2.0 MM. BRASS.

Isodose	Radius	4800 mg-el-hr.	3200 mg.-el-hr.
60.0	0.75	6.00	4.50
40.0	1.00	4.00	3.00
20.0	2.00	2.00	1.50
10.0	2.25	1.00	0.67
5.0	3.75	0.50	0.34
2.5	6.00	0.25	0.175

An application of 3 séances at intervals of eight days with 50 mg. in right and left arms each will give 3 S.E.D. at isodose 40, and 1.5 S.E.D. at isodose 20, due to over-

lapping of the equal intensity curves. The total amount of radiation is 3200 mg-el-hr. from each capsule. Isodose 40 will join isodose 20 at either cornu and hence the combined intensity at these points will be 4.5 S.E.D. At the lateral uterine wall at the level of the internal os, isodose 40 also joins isodose 20 and the combined intensity is again 4.5 S.E.D. In other words, the periphery of the uterus is surrounded by an intensity of 4.5 S.E.D. Should the cancer extend down into the cervical canal then the vertical arm is filled with 50 mg. of radium element. Then the lateral vaginal fornices at isodose 40 each receive 3 S.E.D. plus 0.67 plus 0.67 S.E.D. from isodoses 10 of the upper side arm capsules, a total dose of about 4.35 S.E.D. Within a distance of 1 cm. from the periphery the intensities have decreased to 3 S.E.D., and within 2.5 cm. to about 1 S.E.D.

Should the regional lymph nodes of the first line of defense be involved, namely, the inguinal and femoral nodes, and those of the second line of defense, namely, the iliac nodes, then short wave roentgen rays and the radium cannon are used. The center of the pelvis is avoided by using four fields: two inguinal and two buttocks. The intensities thus obtained may be calculated as shown before.

CONCLUSIONS

The observations recorded here on the lethal radiation dose for cancer cells and the technique of the combined radium and roentgen treatment described lead to the conclusion: (1) That about one-half of the highly anaplastic carcinomas, *i.e.*, transitional round and basal cell and true adenocarcinomas and solid adenocarcinomas will probably succumb to a radiation tissue dose of 2.5 S.E.D. if they extend within a radius of 6 cm. from the cervical canal, and (2) that about 40 per cent of adult squamous cell cancers, malignant adenomas and papillary and gelatinous adenocarcinomas may be killed by a radiation dose of 4 to 5 S.E.D. if contained within a radius of 3 cm. from the axis of the uterus.

The good end-results of radiation treatment might be improved if it became technically possible and safe to increase the applied dose either locally or by distant irradiations. Interstitial irradiation may supply the missing link. However, the technical difficulties in its use are many and probably insurmountable. Many factors must be considered in such investigations. Among them may be mentioned the maximum tolerance of normal cells to radiation, the influence of obliterating endarteritis on the normal tissue, the resistance of the ureters to radiation, the formation of heavy scar tissue, coexisting infections, and so forth.

Such research is tedious and requires a continual follow-up of the cases for many years. However, the progress made along these lines augurs well for the future of radiation therapy. It is apparent that the responsibilities are great and should only be undertaken by those having all the necessary technical facilities and experiences at their command.

DISCUSSION ON PAPERS OF DRS. SCHREINER AND KRESS, AND SCHMITZ

Dr. William P. Healy, New York City. The report of Drs. Schreiner and Kress was very interesting because it comes from an institution which has been going for many years and in which there is excellent organization. As Dr. Kress said, during the years that he assigned to the report they have followed a definite line of treatment. It was interesting to me that apparently they did not at that time use any application of radium against the cervix. All of the application was made by tubes inserted into the cervical canal, plus roentgen irradiation externally. That does not appeal to me as a method of treatment to be adhered to in all cases, because the lesion is seldom symmetrically placed about the cervical canal. In many instances it is so placed that a part of the tumor growth will receive an overdose of radiation while the distant parts may receive an insufficient amount.

As Dr. Kress in his paper emphasized, 86 per cent of their cases were of the advanced type. It would seem to me, therefore, that something

might be done to help these patients live a little longer, not to the five year period perhaps, but several months or a year, by applications of radium made to the cervix through the vagina.

I think it is interesting that they show 38 per cent favorable results in their Groups I and II. These are very favorable groups. I think this percentage should be improved; it is a little low for those groups. The prognosis, as we know, depends on two factors: the early diagnosis and the degree of anaplasia. I think one of the important things they have done to help the advanced case is the uniform use of irradiation by means of the roentgen ray. That, to my mind, is the most important field we have in external irradiation. The fact that 75 to 80 per cent of the cases are incurable when the patients come to us is important, and if we limit the treatment to radium applied at or around the cervix we cannot accomplish as much as we can if we also use the roentgen ray for external irradiation.

Taking up Dr. Schmitz's paper, he emphasized the fact that they have been using in his clinic, since 1914, the combined method of roentgen and radium radiation, using the roentgen ray around the pelvis and the radium at the site of the lesion. That has seemed to us at the Memorial Hospital to be about as satisfactory and practical a method of irradiation as we have available today. There is not a year that comes around, at least since I have been in touch with this problem, that we have not received from Dr. Schmitz encouragement and stimulation by a report which shows good, clear, scientific thought and study on this subject of cancer, and particularly of cancer in the pelvis. It is interesting to us to see how closely we agree in our results and in our deductions with those he arrives at in his study.

Of course, we have no way of knowing what is the lethal dose for carcinoma of the cervix. We personally have made no study. We know the conclusions arrived at by Drs. Quimby and Martin in their study of oral carcinoma. We also know that the cervix cases which have done well have been treated with about the same dosage. It seems that we had arrived at about the same dosage whenever we had favorable results. We have seldom attained it with less than 7 to 12 skin erythema doses, using the combined radium and roentgen radiation. This is not a scientific fact, but from study of some of the favorable cases which have remained well this seemed to coincide with what had been accomplished in oral surgery.

Dr. Harry H. Bowing, Rochester, Minn. The papers by Drs. Schreiner and Kress and Dr. Schmitz were very instructive. Dr. Healy has given a satisfactory summary of these papers, and I shall take up other phases of the subject that are of special interest to me.

The percentage of rectovaginal fistulas, as reported by Dr. Schreiner and Dr. Kress, is, I believe, a little high. However, they see and treat many very extensive lesions and this must be taken into account. This feature of the disease requires special treatment. It is most likely to occur in the stage four group in which ulceration and large craters are found at the first examination. With proper management, potential fistulas may not occur. Should they occur following treatment, as a rule it is late in the disease, probably when the patient is bedridden. Early in our work this complication seemed to occur frequently and the malignant process was usually responsible. However, in recent years we seldom have observed the condition. In the main, the treatment does not differ greatly from that in the average case of an extensive lesion, except that in the presence of a vaginal crater only heavily filtered radiation is applied in the crater. The universal silver tube applicator, the wall of which is 0.5 mm. thick, containing 50 mg. of radium sulphate (element), filtered through 1 mm. brass and 2 mm. lead, is placed in the crater. The time is usually fourteen hours and the number of applications varies with the size of the cavity. It is decidedly advantageous to cleanse the cavity daily and apply mercurochrome solution (2 per cent aqueous) liberally to the walls of the crater. It is gratifying to observe the rapidity with which these cavities will fill in or heal and thus the potential fistula will pass away. I do not know how many of our patients have had fistulas late in the disease, but during the course of treatment or during the subsequent periods of observation we seldom see rectovaginal fixtulas that have followed adequate treatment. I am sure it is possible in a great measure to place this distressing complication in the background and every effort should be made to do so.

Physical measurements as presented by Dr. Schmitz, and by Dr. Healy in his discussion, are decidedly important and point the way to effective treatment. And yet we still have the clinical side to consider. Patients as individuals

do not respond alike; some respond remarkably well to the initial applications whereas others are more resistant. In the main, with the use of physical measurements we assume that all patients respond alike. However, I think it is well worth while to set up a framework of this kind to help estimate or calculate the fields of intensity.

We have found that if we can apply complete treatment at the time the patient is first seen, it is not necessary to repeat it. It may be necessary to treat a small node in the walls of the vagina, and if adequately dealt with, this area of activity usually remains quiescent.

Our most important function as radium therapists is to deal with these lesions adequately when the patient is first seen, since, provided complete treatment can be given, the primary lesion will heal.

Dr. Henry J. Ullmann, Santa Barbara, Calif. I have been particularly interested in the frozen pelvis, the recurrence after full treatment, and what we generally consider hopeless types, for our research has been almost entirely with these. I am beginning to believe more and more strongly that in these patients where our reports, both in this country and abroad, show 1 to 2 per cent five year cures, we may increase that slightly by giving moderate doses of lead with the radiation. For example, the patient whose case I reported nearly a year and a half ago as a recurrence following operation, a case of squamous carcinoma of the cervix, who had had a hysterectomy performed, and who was referred for prophylactic irradiation, receiving a little better than 1000 r, including back-scattering, within a period of two weeks, showed a recurrence within two months. There was a doughnut-shaped mass surrounding the vaginal tip which was necrotic. She received a few injections of lead and more irradiation over a considerable period of time. Twenty-five milligrams of radium element in 3 mm. of lead, as this was the largest applicator we could get into the vagina, was applied for twenty-four hours only. She was given external roentgen irradiation and 300 mg. of lead. I examined her within a period of two weeks and there is still no trace of carcinoma. I have two or three other patients who are progressing in the same way and I wish to make a plea in these hopeless cases for something in addition to irradiation. I am not talking about curing carcinoma, but about increasing the small percentage of cures. It will be particularly valuable in the re-treatment, where we cannot give much irradiation. There is no question that the susceptibility of the growth to irradiation is increased in this way. I do not mean giving large doses of lead which produce toxic effects, but small doses.

No matter what the loss is per day when treating the pelvis, one will get a better depth dose if one gives both the lateral doses in their entirety before the anterior and posterior.

Dr. Leda Stacy, Rochester, Minn. There are two things I wish to mention. First, if the possibility of involvement of the bladder mucosa secondary to the carcinoma of the cervix is kept in mind, the development of a vesicovaginal fistula may be prevented. If a catheterized specimen of urine shows the presence of blood or pus a cystoscopic examination should be made and if edema of the bladder mucosa or ulceration is present the treatment should be modified accordingly.

The work which Dr. Schmitz and Dr. Healy have done in determining the exact peripheral dosage is important. There is little difficulty in destroying the cancerous cells in the superficial ulceration of the cervix but the real difficulty comes in destroying the outlying cancer cells, that is, those in the deep iliac glands and parametrium. This was brought to our attention recently when a patient who was treated in 1922 for extensive carcinoma of the cervix returned to the Clinic. She received a course of about 3000 milligram-hours of radium into the cervix and vagina, one course of roentgen irradiation and one subsequent course of roentgen treatment. She had been perfectly well when she returned for examination on two occasions, but last September, seven years after treatment, she began having pain characteristic of deep glandular involvement, and began taking cinchophen. Shortly afterwards she began having nausea and vomiting, and it was that which brought her back to the Clinic. She presented one of the characteristic pictures of cinchophen poisoning. On examination a little thickening could be felt in the iliac gland region. In spite of treatment she died about sixteen days after the onset of jaundice, with a typical yellow atrophy death, confirmed by autopsy.

I was particularly interested in the autopsy findings in regard to the pelvis. The uterus and ovaries were carefully sectioned but no carcinoma was found in the uterus. There was one mass of infiltration with a few carcinoma cells

but no mitotic figures in the round ligament and around the ovary, but far out there was a large mass with many mitotic figures. We reviewed the specimen that was removed seven years before and found it was the same type of carcinoma. Our attention must be directed toward the destruction of the outlying carcinomatous cells.

Dr. William Neill, Baltimore, Md. The American Society for the Control of Cancer during the last fifteen years has undoubtedly done something toward the education of the public in seeking prompt medical advice for any suspicious lesion or unexplained sign or symptom. It is very distressing to still encounter such a very small percentage of cervical cancers in the operable stage. For the treatment, it is my opinion that radium offers the greater hope of cure. At the Howard Kelly Hospital with radium in early operable cases, the three year cure rate has been 50 per cent; in the borderline group, 31 per cent, while in the inoperable group, which includes extensive infiltration with fixation throughout the broad ligaments, 9 per cent. In another large group hopeless from any operable standpoint, where 1 per cent would be welcome, it has been 10 per cent. I have not done an operation for carcinoma of the cervix in five years. It is still being done at Johns Hopkins, but I think less and less.

I do not advise after the disease has been apparently cured with radium to subject the patient to hysterectomy. We have had no mortality following irradiation. The cause of death in carcinoma of the cervix is due to ureteral pressure causing pyonephrosis or uremia. Palliation is the rule in all cases and I feel the clinical course is better, and that the patients live longer without operation.

All treatments are administered in the knee-chest position without anesthetic, which is of distinct advantage. The radium is inserted intracervically just to the internal os, and topically over the surface of the growth. Discrete masses in the broad ligaments are treated by means of removable emanation points, implanted under anesthesia, with the finger as a guide in the rectum.

Tissue is taken in all cases. It is very interesting to classify the grades of malignancy, but we do not feel that this helps in the prognosis.

As to chronic irritation being the cause of cancer, the Jewish race are prone to multiple pregnancies, but we rarely see carcinoma of the cervix in a Jewess. Carcinoma of the body of the uterus is as common in the Jewish race as in the white, and comparatively rare in the negro. We do not find the resistance to cancer in the colored race as great as in the white.

Our youngest patient was fifteen years old, married and had one child. She died very soon from the disease. The question as to whether we should operate on these early cases or use radium is still not definitely decided, and we need more reports from skilled operators in large clinics in order that a definite comparison may be made. I am going to use radium. I never expect to do another operation for carcinoma of the cervix.

We have had no fistulae as a direct result of irradiation. Radium destroys tissue and does not repair it, and as cancer tissue is destroyed we will occasionally have this complication. We employ the 4.5 gram pack for external radium irradiation, and also use external roentgen irradiation. The skin erythema dose is arrived at with our machine in seventeen minutes, using 40 ma. and 200 kv. We endeavor to cure in one treatment completed in three or four days. The full treatment is never repeated, although it may be necessary to treat some discrete active area later.

Dr. G. Failla, New York City. Judging from Dr. Bowing's remarks, there appears to be a misunderstanding about the value of physical measurements in clinical work. It does not follow at all that the making of physical measurements implies a uniform technique and dosage for all patients one treats. Physical measurements will enable one to estimate what dose reaches the different parts of the irradiated tissues irrespective of the method of treatment employed. Unless this is done one can never form a true estimate of the radiation introduced and the results obtained. The reason for this is that no two cases are alike. For instance, in one case in which the tumor depth is small, one may obtain a good result with a certain dose, while in another case the same *external* dose will give a poor result because, for one thing, the growth did not receive the same amount of radiation as in the previous case. If one makes a chart of the tumor in its relation to normal tissues, one can tell at a glance what amount of radiation is available at the tumor level and if necessary the external dose or the number of fields, radium needles, implants, etc., may be adjusted to the requirements of the case. It seems to me

that this is the only way in which one can draw the proper conclusions as to the effectiveness of a treatment and can utilize the information thus attained in the treatment of other cases.

I wish to make a plea that the work which has been initiated by Drs. Schmitz, Quimby and Martin, be taken up by others. The necessary experimental data are now available to everyone and the calculations are very simple. Both the data and the method of procedure can be found in recent papers by Mrs. Quimby and Dr. Martin.

Dr. J. E. Gendreau, Montreal. I wish to know a little more definitely what is the relation between the skin erythema dose given by Dr. Schmitz and that given at the Memorial Hospital. The latter is about 750 r and the former 1200 r.

If we can improve the deep lethal dose, and it is necessary to improve the lethal dose, why not increase the filter, using for instance 2 mm. of copper? In that way we may be able to deliver a more effective dose to the tumor with the same skin erythema, and evidently if we improve the treatment we will increase our percentage of good results.

Dr. Kress (closing). I think the fact that we have so many fistulae is due to our not selecting our cases. We are running a state-supported institution and the patients come to us with infiltration into the rectum and into the bladder. When that infiltration is there I wish someone would tell me how to treat it and get rid of the malignancy without getting a fistula. We have so many hopeless cases in our series. We try to give these patients all the benefits of irradiation, but we cannot select our cases.

Dr. Schmitz (closing). Early diagnosis is the most important factor in successful cancer therapy. I have for years been evolving a method which in the first place is simple and, second, practical so it may be easily applied by everyone.

The signs are four: First, nodulation; second, ulceration; third, necrosis, and fourth, fixation. These are the most important things to look for. If a nodule bleeds on slight touch, then excise it within the surrounding healthy tissue. Perform frozen section diagnosis and the correct treatment can immediately be instituted. This sign is not accompanied by any symptoms. Hence it can only be found during routine "periodic health" examinations. It is up to us to find the first stage.

The second stage of ulceration is due to the poor blood supply which causes early breakdown. It is associated with "contact" bleeding. If you touch the ulcer it bleeds, and it bleeds continuously and arterially. The ulceration is indicative of beginning invasion of the surrounding tissues. The invasion usually extends 2 to 3 cm. out from the visible and palpable periphery of the tumor. The ulcerating carcinoma is usually not any more a clearly localized or clinical Group 1 carcinoma.

The third sign is due to the fact that the growth necrotizes from lack of blood supply; a crater forms. If exposed to the outer world infection ensues. The symptoms of the necrotic stage are metrorrhagia and putrid discharge.

The fixation stage is characterized by a frozen pelvis. Pain is the principal symptom in addition to metrorrhagia and foul, bloody discharge.

Internal cancers cannot be seen. They grow slowly if they are not infected and the patients live a long time in comfort, finally succumbing to cachexia and asthenia.

The nodular stage without symptoms and clearly localized, offers from 65 to 80 per cent five year good end-results or cures. The ulcerating stage offers from 30 to 35 per cent five year cures; the necrotizing stage from 10 to 15 per cent five year cures; while the last stage with fixation and pain is absolutely hopeless as to five year cures.

The indicated method of treatment may be worked out for each one of these groups and thus the question of surgery versus radiation therapy may be settled to the satisfaction of all concerned.

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THE TREATMENT OF TUMORS OF THE BLADDER*

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A STUDY of the most important literature on the subject of tumors of the bladder appearing during the past two years, shows that there is a considerable uniformity of opinion in regard to classification, but that there still exists a rather wide divergence of view as to the efficacy of the different therapeutic measures and the indications for their choice. The terms benign and malignant papilloma, papillary carcinoma and infiltrating carcinoma are generally used to designate the more important types of tumor which occur in the bladder, but there are considerable differences in the criteria which are used by individual observers to classify different tumors. At present there is a general uniformity of opinion that all epithelial tumors of the bladder are potentially malignant as has been emphasized by Hinman, Macalpine, Frater, and others, and this characteristic has the most important bearing on the method of treatment to be chosen.

The fact that tumors often grow by continuity from the original growth and especially by implantation apparently from small pieces of the original tumor in different parts of the bladder is well recognized and this fact too has an important bearing on therapeutic measures. The tendency to implantation of small pieces of tumor is frequently seen in the case of pedunculated tumors, and all authorities agree that by open operation the chances of implantation are greatly enhanced. When such implantation occurs following operation the growth often takes on a sessile villous appearance, and these recurrences are definitely more resistant to electrocoagulation and radium treatment than the original tumor, and tend to degenerate more quickly into typical infiltrating growths. This malignant degeneration is seen invariably if the implantation occurs in a suprapubic wound. Scarcely a year passes in our clinic that we do not see a sad example of malignancy in a suprapubic scar which is beyond control and which was transplanted from what was in all probability originally a growth of low malignancy.

Ever since modern cystoscopic methods have made possible the scientific study of the growth of tumors of the bladder, attempts have been made to more accurately determine their nature by excision of small portions of the tumor by endovesical methods for microscopic examination. The work of Broders, who classifies all forms of malignant growth according to the individual cell characteristics into four distinct groups, has stimulated great interest in a study of tumors of the bladder by excision of bits of the tumor for biopsy. Bumpus and Hunt, in studies from the Mayo Clinic, believe that they can show that tumors graded in the more malignant classes show a much higher mortality. Bumpus states that tumors graded under the first two groups of malignancy may be treated by electrocoagulation through the cystoscope. He has discontinued the use of radium entirely and in the more malignant types uses excision where possible, or diathermy. Hunt has found that 65 per cent of patients operated on for tumors of grade 1 and 2 are alive three years or more after operation, while only 34 per cent of patients in grades 3 and 4 are alive after three years. Aschner reports a study of 285 cases with biopsy findings, and states that reliable information as to the nature of bladder tumors is obtainable by cystoscopic biopsy in 95 per cent of the cases. He states that failures occur in multiple tumors and papillomatosis. He believes that the prognosis cannot be determined by biopsy alone.

* Read at the Fifteenth Annual Meeting, American Radium Society, Detroit, Mich., June 23–24, 1930.

For several years it was the custom of Dr. Geraghty of the Brady Clinic to take routine biopsy specimens of all tumors observed, but it was soon felt that the knowledge gained from the study of these small specimens in regard to the tumor in question could not be compared to the actual observation of the tumor itself with the cystoscope, with special reference to the character of the villous or papillary process, the presence of pedicle and signs of infiltration in the bladder wall and about the base. We have also been able to show that there may exist considerable differences in structure and also in microscopic anatomy in different portions of the same bladder tumor. We have one tumor in our collection which shows on section through the outer portion a typical papillary carcinoma, while sections taken through the base show cellular arrangement which can scarcely be distinguished from sarcoma. There are other specimens of papillary tumor which show cells of relatively benign character at the surface of the growth while definite invasion is occurring at the base. On this account, it has seemed to us to be somewhat risky to draw conclusions as to the nature of the tumor from the study of a small portion excised from one part of the growth and as a result of this necessarily limited study to apply therapy. It has therefore been our custom in the diagnosis of bladder tumors to classify them for therapy entirely according to the cystoscopic appearance.

The presence of a definite pedicle is of the utmost importance as regards both therapy and prognosis. Pedunculated tumors are rarely infiltrating. Occasionally one may see direct extension of the growth spreading out from the pedicle and superficial infiltration may occur. In the majority of cases, however, on cystoscopic examination the pedicle cannot be definitely seen as the papillary villous processes hang down and rest upon the bladder wall thus obscuring the view. From the cystoscopic standpoint entirely, we have come to classify all bladder tumors under three heads: (1) pedunculated tumors, which are usually not infiltrating but may rarely be infiltrating; (2) sessile tumors, which may be non-infiltrating or infiltrating, and (3) true infiltrating tumors.

During the last ten years or more it has been our custom at the Brady Clinic to treat pedunculated tumors entirely by means of a combination of electrocoagulation and surface application of radium, and our very gratifying results with this type of tumor have confirmed us more and more in the opinion that in the case of pedunculated tumors operation should never be carried out except in exceptional circumstances. From a purely theoretical standpoint, the procedure is ideal in that the surface of the tumor is destroyed, no great degree of trauma is done and in this way the chance of implantation is greatly lessened and in most cases is nil. In the case of the so-called benign papilloma with small pedicle, the whole growth can often be destroyed at one treatment and subsequent cystoscopic examinations are carried out to observe the character of the resultant ulceration where the pedicle has been destroyed. The manner in which the different pedunculated tumors respond to electrocoagulation is an excellent indication of their degree of malignancy as has already been emphasized by numerous observers. It will be found that some tumors with a broad pedicle and with fused villous processes respond sluggishly to the electric spark, while the typically benign type can be destroyed by a single application for a short time. We feel that in the treatment of the former type, surface applications of radium are of the utmost importance. We never attempt to destroy pedunculated tumors by the use of radium alone, but when a tumor responds sluggishly to electrocoagulation, radium applications are carried out, and in most cases the whole character of the tumor seems to be changed in that at subsequent cystoscopic examination the tumor will be found to respond rapidly to the high frequency spark. It is difficult to give statistics on a question of

this sort, but the experience of all engaged in the treatment of bladder tumors at the Brady Clinic is the same, and as our experience grows our confidence in the combined method becomes more firmly grounded.

Surface applications of radium are also used in the case of typically benign papillomata with a long pedicle. This treatment is given empirically and is based on the definite effects of radium which we have noted in the more malignant tumors. The tumor is first destroyed by electrocoagulation and the base then subjected to from 200 to 400 mg-hr. of radium in the belief that by this irradiation any remaining cells which may have escaped the high frequency current will be destroyed. All cases so treated are reëxamined, wherever possible, at intervals of three months, six months, and a year after the treatment has been completed and subsequently at yearly intervals. Our percentage of recurrences is extremely small and when such recurrences are observed they can be quickly controlled by the combined treatment.

We have had experience also with very large pedunculated tumors in which this combined treatment has been completely successful. In a recent personal case an enormous pedunculated tumor almost filling the bladder cavity was causing so much obstruction that trabeculation was present on the posterior bladder wall. On account of the large size of the tumor and on account of bleeding at the first examination no treatment could be carried out. The patient was given a surface application of 400 mg-hr. of radium and in about two weeks cystoscopic examination showed that the tumor had been so reduced in size that electrocoagulation was possible, and the tumor was completely destroyed in four treatments. There has been no recurrence for one year and the scar at the site of the pedicle is perfectly smooth.

The advantages of the combined treatment over operation are so evident that we feel that there is no choice. Suprapubic cystotomy in itself has a certain definite mortality and chances of infection are always present. No matter how carefully the exploration of the tumor is carried out it is often technically impossible to excise the tumor without traumatizing at least to some extent.

For the surface application of radium we use exclusively the cystoscopic applicators devised by Dr. Young. Two platinum capsules 1 mm. thick, each containing 100 mg. of radium element, are used. These capsules are inserted side by side in a gold or silver capsule, which in turn is held in a tubular beak of the applicator. The cystoscope is then passed through the sheath of the applicator and the capsule containing either 100 or 200 mg. of radium, as the case may demand, can be accurately placed on any portion of the tumor under direct vision. The desired position is maintained by fixing the applicator in place by means of a clamp attached to the cystoscopic table. For surface applications our usual custom is to give treatments of 100 to 200 mg-hr. at each seance. We rarely give over 800 mg-hr in one particular course. When radium was first used at the Brady Clinic, overenthusiasm led to one or two severe burns, but in the past ten years we have had no repetition of this unfortunate experience.

In the treatment of sessile tumors the same general principles as those guiding the management of pedunculated tumors are employed. High frequency current is applied and response of the tumor carefully noted at the next cystoscopic examination. If this response is noted to be sluggish, applications of radium are instituted and electrocoagulation is given either then or at a later date. If the tumor appears resistant to an adequate mixed course of radium and electrocoagulation, we consider that this resistance is strongly indicative of infiltration, and we then institute procedures which we employ in this latter class of growths.

The question of infiltration in bladder tumors is, of course, of paramount importance and the diagnosis in borderline cases requires a wide cystoscopic experience. In

the earliest stages of infiltration there is often no change in the surrounding mucous membrane, but soon this will take on a congested irregular appearance and later show bullous edema and submucosal nodulation. Ulceration of the surface of the tumor not dependent on previous treatment is of the utmost significance, especially if the ulceration becomes excavating. When the diagnosis of infiltration has been clearly established it is our custom to carry out wide segmental resection. If the tumor is at the vertex or on the posterior wall the resection includes the peritoneum. If deeper portions of the bladder are involved, partial mobilization of the bladder is done preliminary to resection. Our statistics show that the ultimate result in tumors where resection is possible, is far superior to other methods. The size of the tumor itself is rarely a contraindication to resection, but infiltration of the trigone and involvement of the prostatic orifice often renders complete resection technically impossible. Encroachment of the tumor on one ureteral orifice is not a contraindication, though transplantation of the ureter greatly complicates the operation and increases the mortality. When an infiltrating tumor has been found on cystoscopic examination to be inoperable from the standpoint of complete resection, a course of surface radium applications, combined with rectal applications in order to attain a cross-fire effect is instituted and in addition a course of deep roentgen therapy is carried out at the same time. In some few cases treated by this method remarkable results have been obtained and deeply infiltrating tumors have been completely destroyed.

The part played by roentgen therapy is very difficult to define. We believe that it has a definite adjuvant effect and that some of our fortunate results would have been impossible without it. We have come to regard it in its relation to radium very much like the relation of radium to electrocoagulation in tumors which are resistant to the latter method. The beneficial effect of deep roentgen therapy in advanced cases with severe pain from nerve root pressure is too well known to require comment.

Unfortunately, in the majority of deeply infiltrating tumors the combined treatment will prove ineffectual and open operation is then indicated. When the tumor has been thoroughly exposed through the open bladder it is completely destroyed by diathermy, which should be employed with the utmost care to avoid injury to the underlying rectum. The necrotic tumor is then implanted with small radium needles, care being taken to place the needles about the periphery of the tumor at a distance of about 1 cm. from each other, and as many needles as may be necessary are implanted in the base, at the same distance from each other. These small needles each contain 1 mg. of radium in a platinum capsule, 1 mm. in thickness. The end of the capsule contains an eyelet through which heavy silk has been threaded so that the needles can be removed when the necessary dosage has been attained. The dosage usually given varies from 1000 to 2000 mg-hr.

CONCLUSIONS

1. The presence or absence of infiltration is the most important character of any bladder tumor and must be determined as accurately as possible before the question of treatment can be approached in an intelligent manner.

2. A careful cystoscopic examination is the most accurate method which we have at our disposal to determine this point.

3. Non-infiltrating tumors are best treated by a combination of endovesical electrotherapy and direct radium application.

4. By direct application of radium, resistant tumors can usually be made to respond promptly to the high frequency spark and the chances of recurrence are markedly diminished.

5. Infiltrating tumors should be treated by resection whenever this procedure can be safely carried out. When resection is impossible the tumor should be destroyed by diathermy through the open bladder

and radium seeds implanted throughout its base.

6. The intelligent treatment of bladder tumors can only be carried out by a combination of long experience with cystoscopic and electrotherapeutic methods, thorough knowledge of the technique of application and therapeutic results of radium and deep roentgen therapy and thorough surgical experience in the treatment of these growths.

REFERENCES

1. Aschner, P. W. The pathology of vesical neoplasms; its evaluation in diagnosis and prognosis. *J. Am. M. Ass.*, 1928, *91*, 1697–1704.
2. Barringer, B. S. End-results of radium removal of carcinoma of the bladder. *J. Am. M. Ass.*, 1928, *90*, 352–354.
3. Beer, E. Physical agents in the treatment of bladder tumors. *Am. J. Surg.*, 1928, *4*, 113–132.
4. Bumpus, H. C. Jr. The present methods and results of treating tumors of the bladder. *J. Urol.*, 1929, *21*, 371–380.
5. Chute, A. L. Some clinical observations on tumors of the bladder. *Am. J. Surg.*, 1928, *5*, 217–228.
6. Fleischman, A. G. Treatment of tumors of the bladder by surgical diathermy. *Arch. Physical Therapy*, 1928, *9*, 523–531.
7. Fleischman, A. G. The treatment of tumors of the bladder by means of surgical diathermy. *J. Iowa M. Soc.*, 1928, *18*, 1–7.
8. Frater, K. A study of epithelial neoplasms of the urinary bladder. *J. Urol.*, 1928, *20*, 371–386.
9. Hinman, F. The surgery of tumors of the bladder. *Calif. & West. Med.*, 1929, *31*, 116–124.
10. Hunt, V. C. The surgical treatment of malignant tumors of the bladder. *J. Am. M. Ass.*, 1928, *91*, 1704–1708.
11. Kaufman, L. R. Tumors of the bladder and prostate with special reference to cancer. *Surg. Clin. N. Am.*, 1929, *9*, 701–731.
12. Keyes, E. L. Principles governing the local treatment of carcinoma of the bladder. *J. Am. M. Ass.*, 1928, *90*, 350–352.
13. Krengenburg. Geschwülste der Harnblase. Verhandl. d. 2 Kong. Russ. Urol. Leningrad, 1928.
14. Macalpine, J. B. Papilloma of the bladder. *Brit. M. J.*, 1929, *2*, 794–799.
15. Morson, A. C. Observations on the radium treatment of vesical carcinoma. *Lancet*, 1928, *2*, 116–119.
16. Morton, H. H. Removal of benign papilloma of the bladder by Zuckerhandl forceps. *Urol. & Cutan. Rev.*, 1928, *32*, 13.
17. Negley, J. C. Bladder tumors. *Calif. & West. Med.*, 1928, *28*, 345–349.
18. Stevens, W. E. Treatment of malignant tumors of the bladder, with special reference to surgical diathermy. *Calif. & West. Med.*, 1929, *30*, 29–35.
19. Wilhelmi, O. J. Bladder tumors; removal with fulguration. *J. Missouri M. Ass.*, 1928, *25*, 199–201.
20. Young, H. H. Malignant tumors of the bladder and prostate. *Am. J. Surg.*, 1929, *6*, 667–678.

DISCUSSION

Dr. William Neill, Jr., Baltimore, Md. I am sure we are all glad of the opportunity to listen to Dr. Colston's paper. The treatment of bladder tumors by any method is one of our most difficult problems. Until the advent of radium, bladder tumors, so long treated as the stepchild of urology, have in recent years taken on a new interest. In 1910 Beer gave us the method by which we could handle the nonmalignant type of tumors, but in the malignant group it is useless.

We see many of these cases at the clinic, fortunately, most of them in women where exposure is less difficult; the ratio is approximately one man to five women. In women the treatment is facilitated by using the knee-chest position and the Kelly open air cystoscope. I have done this in a few instances in the male with the patient in the knee-chest position or an exaggerated Trendelenburg position as advocated by Luys of Paris, but it is as a rule unsatisfactory, and we use one of the lens water cystoscopes.

I was glad to hear Dr. Colston say that only occasionally do they do a suprapubic section. I have always felt that this added to the difficulties, and many die from various postoperative complications.

I have found that electrocoagulation of these malignant tumors does not cure, and possibly tends to aggravate them, but it has a field in destroying the massiveness of the tumor and checking bleeding prior to the implantation of radium. In the massive growths, where a lot

of sloughing is desired, I still use the bare seeds, but in the average case we employ the gold-covered ones with the strings by which they can later be removed. The diagnosis is quickly arrived at by the history, cystoscopic examination and bimanual palpation. The cystoscope is the chief aid in diagnosis, and every patient with a history of blood in the urine should be subjected to a cystoscopic examination.

We remove tissue for classification of the malignancy, but do not feel that this has any bearing on the prognosis. This is also true in carcinoma of the fundus and cervix uteri. The treatment through the surface of the body is given either by radium or roentgen radiation. If 3 or 4 grams of radium are available I much prefer it, for penetration equal to that of radium has never been developed in the roentgen tube. Intravesical treatment is administered by direct surface application plus the implantation of radon, either bare or encased in gold. For this we use a cystoscope identical with the idea advanced by Dr. Hugh Young. Our main reliance is the surface and interstitial application, although the external application is of definite assistance.

This condition is prone to recur and it is very important that complete follow-up examinations be carried out in every case at frequent intervals.

We have had 186 cases, divided into two groups: the extensive or hopelessly inoperable from the standpoint of resection, 111 cases, with a three year cure of 10 per cent. Where it was possible to consider surgical resection but, treated by irradiation we have had 59 cases with a cure rate of 55 per cent. The remaining 16 were benign papillomata, treated by fulguration plus irradiation with good results. Palliation is the rule in the far advanced. The treatment of bladder carcinoma is an important and difficult subject. No one should attempt treatment of this disease in fairness to his patient unless he be well trained in the science of radiology and urology.

DR. COLSTON (closing). Our problem, of course, as in every other malignancy, lies in early diagnosis. It is very rare for us to see a case of bladder tumor that has not been bleeding for six months or more. We have had cases that have bled over a period of ten years. These patients have been put to bed at intervals until the bleeding stopped, but no thorough examination had been made. This is very discouraging.

I think success in treatment depends to the largest extent upon the cooperation of the urologist and the radiologist. By urologist I mean the man who has had wide experience in cystoscopy and also is well trained as a surgeon.

In conclusion, I wish to express my appreciation of the papers we have heard here today, and to thank the Society and its President for their courtesy in inviting me to be present.

Vol. XXV, No. 3

MEGADUODENUM*

CASE REPORT

By CLINTON G. LYONS, M.D.
Roentgenologist, Edward Hines Jr. Hospital
HINES, ILLINOIS

THE following case is reported primarily because of the exceeding rarity of the condition. A search through modern textbooks and literature fails to reveal a similar case recorded.

White male, aged forty-three, was admitted to Edward Hines Jr. Hospital with a diagnosis of carcinoma of the stomach.

The family history of the patient was negative for tuberculosis, cancer and mental disease. The patient was unable to flex the thighs without aid. Both lower extremities were edematous, the right more than the left. The throat appeared normal; pyorrhea about the remaining lower teeth. No adenopathy. Thyroid normal. The heart was normal in size, regular, no murmurs, rate 116. The clavicles were prominent; dullness over the right, excursion poor; no dullness or râles. Peristaltic waves were visible in the epigastrium; no tumor palpable; liver and spleen not palpable, no ascites.

FIG. 1. The immediate film of the stomach, duodenum and first portion of the jejunum showing marked dilatation of the latter, giving the impression of a double stomach.

FIG. 2. Showing the stomach empty. Head of the opaque column hestitating in the first portion of the jejunum.

Patient stated he has had gastrointestinal trouble for many years, especially in the last fifteen years. During the past year he has been much worse, he has very little pain but has considerable nausea and when he vomits he throws up a large amount of fluid or food residue.

The patient gave a history of vomiting at intervals since childhood. At first he vomited perhaps an hour after breakfast, four or five times a year. Since 1919 vomiting has been frequent, of large amount and bile stained. Blood was never vomited or noted in the stools. Pain was absent. No history suggestive of peptic ulcer could be obtained. He has always been underweight and lacked strength to earn a live-

* Published by authority of Charles M. Griffith, Medical Director, United States Veterans Bureau.

Fig. 3. Showing regurgitation of the barium into the stomach; also a small amount of barium passing the obstruction.

lihood. Since last November he has been much worse in regard to vomiting. The lower extremities were weak.

The roentgen examination revealed the opaque medium passing the esophagus without hesitation or delay. The stomach filled normally forming a low fish-hook type. Contour of greater and lesser curvatures was regular; stomach freely movable. The lowest point on the greater curvature was 6 cm. below the crest of the ilium. Peristalsis sluggish. No definite tenderness elicited on deep palpation. The stomach emptied readily by manipulation. The first, second and third portions of the duodenum showed marked dilatation accommodating the entire gastric meal and was slightly larger than the stomach silhouette.

The roentgenographic examination confirmed the roentgenoscopic findings, showing on the immediate films a very remarkable condition, in that the duodenum was dilated to an enormous degree giving a roentgen impression of a double stomach (Fig. 1). The duodenum and the first portion of the jejunum showed a transverse diameter of 8 cm. or approximately three times the width of the transverse colon.

The one hour film revealed the stomach empty with the exception of a thin coating of barium covering the mucous membrane revealing a faint outline of this organ (Fig. 2).

The two hour film (Fig. 3) showed a reverse peristalsis with approximately 60 c.c. of barium in the region of the pylorus, due to regurgitation of the opaque meal.

The twenty-four hour film (Fig. 4) showed a faint outline of the stomach, duodenum and first portion of the jejunum. The transverse colon was of normal size and shape crossing the abdomen opposite the body of the third lumbar vertebra. Haustrations were of normal and even width showing no alteration in appearance to suggest organic pathology.

The descending colon took an oblique course downward and inward to the region of the right iliac fossa (Fig. 5). The unusual position of the descending colon was attributed to an anomaly. There was no evidence of adhesions or extrinsic pressure to this region. Haustrations were regular in outline.

Conclusions. 1. Obstruction of the jejunum. 2. No evidence of carcinoma.

Exploratory operation of the abdomen confirmed the roentgen findings, revealing bands of

Fig. 4. Showing a normal transverse colon with a large amount of barium in the dilated duodenum, jejunum and stomach.

Fig. 5. Showing an opaque enema filling the rectum, sigmoid and colon, exhibiting a transposed sigmoid.

adhesions encircling the jejunum approximately 28 cm. from the duodenal junction.

Since operation, the patient has been symptom-free, no nausea or vomiting; has gained weight and claims he feels better than he has for many years.

A roentgen examination of the gastrointestinal tract six weeks after the laparotomy showed the duodenum greatly reduced in size and shape and assuming the normal appearance. The motor meal passed the duodenum and jejunum without hesitation.

REFERENCES

1. Brown, Samuel. Gastro-intestinal obstructions. *Radiology*, 1930, *15*, 364–373.
2. Burgess, A. H. Address on acute intestinal obstruction. *Lancet*, 1929, *1*, 857–859.
3. Case, James T. Stereoroentgenography of the Alimentary Tract. 1915, Volume III.
4. Cheney, William F. The Diagnosis and Treatment of Diseases of the Stomach and Intestines. Henry A. Christian, Editor. Oxford University Press, New York, 1928.
5. Miller, C. J. A study of 343 surgical cases of intestinal obstruction. *Ann. Surg.*, 1929, *89*, 91–107.
6. North, John P. Acute intestinal obstruction. *Internat. Clin.*, 1929, *3*, 206–215.

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Publisher: Charles C. Thomas, Springfield, Ill.

Issued Monthly. Subscription $10.00 per year, $11.00 in Canada and $12.00 in foreign countries. Advertising rates submitted on application. Editorial office, 110 Professional Building, Detroit, Mich. Office of publication, 220 E. Monroe St., Springfield, Ill. Information of interest to all readers will be found on page iv.

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EDITORIALS

ROENTGEN DIAGNOSIS OF COARCTATION OF THE AORTA

THE heart and aorta on account of their anatomical situation have since the early days of the roentgen ray been the source of considerable study by roentgenologists both on the normal and on the pathological. Roentgenologists, however, have apparently been overlooking one somewhat rare condition in deformity of the aorta, namely, stenosis of the descending arch, or coarction, of the aorta. That this condition is not as unusual as was at one time supposed is indicated by the recent publications dealing with the roentgenologic manifestations of this condition. Fray[1] in a recent article called attention to the fact that "the diagnosis of coarctation is rarely made during life, though post-mortem experience would indicate that this condition is not extremely uncommon. . . ." "The roentgenologic aspects of this anomaly have not been definitely considered in the past by roentgenologists but have been discussed by clinicians, whose opinion of the roentgen diagnosis is not based upon modern roentgenologic knowledge or technique," and many clinicians have expressed a very pessimistic attitude toward the help which the roentgen ray may give. King[2] in a report of four cases which had been recognized clinically at the Johns Hopkins Hospital during the course of thirty-seven years states that the roentgenograms are disappointing and that probably this disappointment is due to the fact that the location of the coarctation behind the cardiovascular stripe makes it an unfavorable site for inspection and concludes that the chief value of the roentgen ray is in the exclusion of aneurysm. Blackford[2] also shares this opinion and says that the chief value of the roentgen ray in the examination of the thorax is the excluding of aneurysm, and the roentgenologic literature, aside from one reference, also fails to call attention to the possibility of making a correct diagnosis of this condition.

The first article calling attention to the importance of the roentgen ray in the diagnosis of coarctation, or stenosis, of the aorta, is that by Railsback and Dock[3] who called attention to the symmetrical erosion of the ribs as the result of the hypertrophy of the intercostal arteries. This observation had previously been made at autopsy but its easy identification by means of the roentgen ray had formerly been overlooked.

Fray in his very comprehensive and critical analysis of the two cases which he reported called attention to the fact that if coarctation is suspected a very careful roentgenoscopic and roentgenographic examination of the chest should be made from all angles, searching particularly for a defect in the continuity of the arch and for erosions in the ribs posteriorly. He calls particular attention to the importance not only of examining the patient in the posteroanterior direction but also of making a thorough study in the left oblique position, where a clear view of the arch of the aorta can be obtained, in order to study that portion of the arch which is involved in cases of stenosis or coarctation. The left posteroanterior oblique chest film, if properly exposed, shows practically the entire

[1] Fray, Walter W. The roentgenologic diagnosis of coarctation of the aorta (adult type). Am. J. Roentgenol. & Rad. Therapy, 1930, *24*, 349–362.

[2] Referred to by Fray.

[3] Railsback, O. C., and Dock, William. Erosion of the ribs due to stenosis of the isthmus (coarctation) of the aorta. *Radiology*, 1929, *12*, 58–61.

aortic arch and while this view, namely, the left posteroanterior oblique, is of particular value for a study of other types of aortic disease such as arteriosclerosis, dilatation and aneurysm, its value in the detection of a possible stenosis or coarctation of the aorta had not been fully appreciated until attention was called to it by Fray. In cases of coarctation a "defect or break in the continuity of the aortic outline at the upper end of the descending limb of the aorta" occurs. The defect in the aortic arch in the cases reported by Fray occurred in that portion of the arch below the subclavian at or slightly below the point of connection between the ductus arteriosus and the aorta. A defect or break in the continuity of the arch in the region described is pathognomonic of coarctation and this demonstrable defect associated with erosion of the ribs in the posterior aspect of the chest establishes the diagnosis beyond doubt. But that coarctation of the aorta may occur without rib erosion has been shown in a number of cases. Therefore it is essential in making a diagnosis that one demonstrate a characteristic defect in the arch of the aorta as shown in the oblique view, and the demonstration of this defect constitutes the most reliable single roentgen finding in coarctation, whereas the other findings are suggestive or merely corroborative only.

A still more recent article on stenosis or coarctation of the aorta by Ernstene and Robins[4] emphasizes the points which were brought out so strikingly in Fray's article. They had the unusual opportunity of corroborating the roentgenoscopic and roentgenographic findings by a necropsy, at which time the arterial vascular system was injected with a suspension of barium sulphate in agar and sodium iodide solution, and roentgenograms were taken which verified the roentgen observations of stenosis of the aorta, and showed the marked hypertrophy and tortuosity of the intercostal arteries which caused the rib erosion observed on the film taken during life.

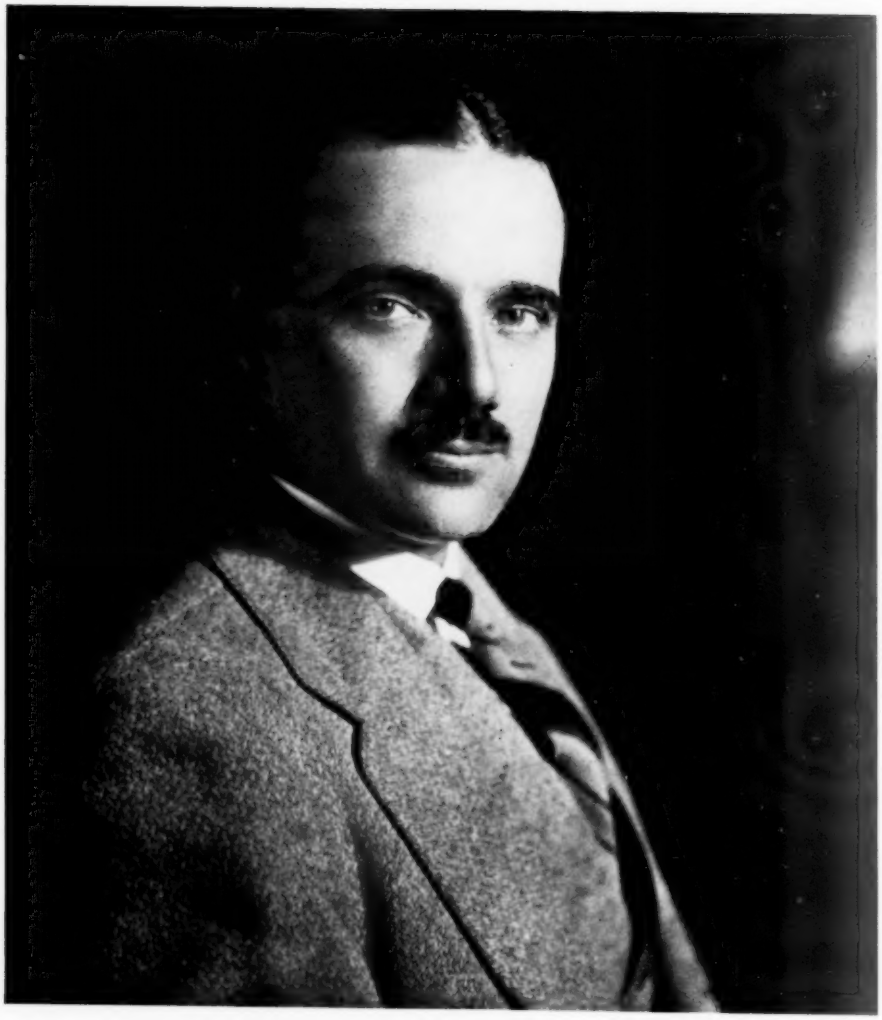
It can readily be seen from the early report of Railsback and Dock and the subsequent reports of Fray, Ernstene and Robins that in a careful roentgenoscopic and roentgenographic examination of the chest a correct diagnosis of this condition can be made independent of clinical observation.

The work of Fray and of Ernstene and Robins emphasizes anew the importance of a careful roentgenoscopic and roentgenographic technique and again emphasizes the fact that our advances in roentgenologic diagnosis go hand in hand not only with knowledge and conception of the various pathologic states which may exist but also with improvements in technique.

[4] Ernstene, A. Carlton, and Robins, Samuel A. The roentgenologic diagnosis of stenosis of the descending arch (coarctation) of the aorta. Am. J. Roentgenol. & Rad. Therapy, Feb., 1931, *25*, 243–246.

NEW DEPARTMENTAL EDITOR

With the current issue of the Journal there is a new departmental editor for the Department of Technique, Dr. Robert B. Taft, of Charleston, S. C. After giving many years of splendid service to this department of the Journal, Dr. Bowen feels that his hospital duties demand more of his time and what leisure moments he has he desires to devote to other pursuits and interests. He has, however, promised to maintain the kindly interest in the Journal which he has always manifested. His resignation from this task carries with it a sense of regret to those of us who have to do with the editing of the Journal. We feel certain, however, that in appointing Dr. Taft to succeed him the Journal enlists the services of one who is thoroughly capable. His many ingenious contributions to the mechanical side of roentgenology fully qualify him for editor of the Department of Technique.



Webster W. Belden
1892–1930

WEBSTER W. BELDEN

1892 – 1930

THE news of the sudden and untimely death of Dr. Webster W. Belden came as a great shock to his many friends and associates. The circumstances of his illness and its fatal outcome were particularly sad as Dr. Belden was on a trip combining pleasure and professional interests. After attending the annual meeting of the Radiological Society of North America he was en route to his native town, New Orleans, to visit relatives and to attend a reunion of his boyhood friends, when he was taken ill with pneumonia, resulting in his death a week later at the Touro Infirmary in New Orleans. He was buried at Biloxi, Mississippi, where he had spent much of his boyhood and which he had always wished should be his final resting place.

Dr. Belden came of a family of physicians, both his father and grandfather having been members of the medical profession. He was born October 23, 1892, in New Orleans, where he received his early education and later attended Tulane University, receiving the degree of B.S. in 1913 and his medical degree in 1916. Dr. Belden subsequently came to New York City, where he did postgraduate work at Cornell and served his internship at Roosevelt Hospital. During the World War he enlisted in the Medical Corps and served as Adjutant in the Army Medical School. Later he was commissioned Captain and was in charge of Base Hospital No. 1 and later No. 41. On his discharge from the army Dr. Belden became associated with Dr. H. M. Imboden, with whom he remained for three years, leaving Dr. Imboden to establish an office in Montclair, N. J. In 1923 Dr. Belden was appointed Director of the Radiological Department of the New York Hospital, which position he held at the time of his death.

Dr. Belden was a member of the American Roentgen Ray Society, the Radiological Society of North America, the American Medical Association, New York State and County Medical Societies, the New York Roentgen Society and the Clinical Roentgen Society of New Jersey. He was one of the early members of the New York Roentgen Society and was always among its active workers, being deeply interested in its advancement and serving the Society in all its offices—as Secretary, Treasurer, Vice-President and President.

While not a prolific writer, Dr. Belden had added materially to the literature, some of his work being outstanding. Among his contributions were: "Some X-ray Findings in Lobar Pneumonia"; "Roentgenological Consideration of the Mediastinum; "Bone Diseases"; "Secondary Evidence of Gall-Bladder Disease"; "The Fifth Lumbar Vertebra Roentgenologically Considered"; "Intrathoracic Tumors and their Treatment"; "Further Study of Osteitis Deformans and its Therapeutic Treatment."

Despite his comparative youth Dr. Belden ranked high in his specialty and gave promise of a brilliant and useful future. His untimely death leaves a vacancy not easily filled and must be regarded as a distinct loss to the profession. Whatever he did was done wholeheartedly, and whether he worked or played, it was always with keen interest and enthusiasm. He played hard, but this meant that he worked the harder to compensate for his pleasure.

To be able to call Dr. Belden a friend was a privilege. To know him was to love him, but to be his friend was an honor. In the true sense of the word Dr. Belden had few "friends", but for these no service was too hard, no sacrifice too great. Those who knew him well will always cherish his memory.

JOHN REMER

RESOLUTIONS OF THE NEW YORK ROENTGEN SOCIETY

THE New York Roentgen Society was shocked to learn of the untimely demise of Webster W. Belden, one of its most active members, who has served it loyally as member and in the capacity of Secretary, Treasurer and President; who has made many important contributions to the science of roentgenology, and from whom it felt justified to expect a great deal more in the furtherance of the specialty; who upheld the high standards of his vocation as set forth by his grandfather and father, both of whom were honorable members of the medical profession.

The Society feels his loss very keenly and therefore

Resolves: To spread upon its minutes these sentiments of its love and respect for the departed member, and further

Resolves: To express to his widow, his children, his aunt and his many devoted friends its most heartfelt sympathy, and further

Resolves: That in token thereof a copy of these minutes be forwarded to the America Journal of Roentgenology and Radium Therapy, another to his widow and children, and another to his aunt.

H. M. Imboden, M.D.
L. Jaches, M.D.
J. Remer, M.D.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this section solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

American Roentgen Ray Society
Secretary, Dr. John T. Murphy, 421 Michigan St., Toledo, Ohio.
Thirty-second annual meeting: Atlantic City, N. J., 1931.

American College of Radiology
Secretary, Dr. Albert Soiland, 1407 S. Hope St., Los Angeles, Calif.
Annual Meeting: Philadelphia, 1931.

Section on Radiology, American Medical Association
Secretary, Dr. G. W. Grier, Jenkins Arcade, Pittsburgh, Pa.
Annual meeting: Philadelphia, June 8–12, 1931.

Radiological Society of North America
Secretary, Dr. I. S. Trostler, 812 Marshall Field Annex, Chicago, Ill.
Seventeenth annual session: to be announced.

Radiological Section, Los Angeles County Medical Society
Secretary, Dr. John F. Chapman, 209 Professional Bldg., Pasadena, Calif.
Meets on the third Wednesday of each month at the California Hospital.

Radiological Section, Southern Medical Association
Secretary, Dr. W. S. Lawrence, Medical Arts Bldg., Memphis, Tenn.

Brooklyn Roentgen Ray Society
Secretary, Dr. J. J. Masterson, 401-76th St., Brooklyn, N.Y.
Meets monthly on the first Tuesday from October to April.

Buffalo Radiological Society
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St.
Meets second Monday of each month except during the summer months, the place of meeting to be selected by the host.

Chicago Roentgen Society
Secretary, Dr. George M. Landau, 660 Groveland Park.
Meeting second Thursday of each month October to May inclusive at Virginia Hotel.

Cleveland Radiological Society
Secretary, Dr. A. Srauss, 518 Medical Arts Bldg.
Meetings are held at 6:15 P.M. at the Cleveland Chamber of Commerce Club rooms on the fourth Monday of each month from October to April, inclusive.

Detroit Roentgen Ray and Radium Society
Secretary, Dr. E. R. Witwer, Harper Hospital.
Meets monthly on first Thursday from October to May, at Wayne County Medical Society Building.

Central Illinois Radiological Society
Secretary, Dr. H. C. Kariher, Decatur, Illinois.
Regular meetings held quarterly.

Indiana Roentgen Society
Secretary, Dr. J. N. Collins, Indianapolis, Ind.
Annual meeting each February 22 in Indianapolis.

Milwaukee Roentgen Ray Society
Secretary, Dr. J. E. Habbe, 221 Wisconsin Ave., Milwaukee.
Meets first Friday in October, December, February and April.
Place of meeting designated by the president.

Minnesota Radiological Society
Secretary, Dr. L. G. Rigler, University Hospital, Minneapolis, Minn.
Next meeting: Minneapolis, May 4, 1931.

New England Roentgen Ray Society
Secretary, Dr. Thomas R. Healy, 370 Marlboro St., Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

New York Roentgen Society
Secretary, Dr. J. Bennett Edwards, Englewood Hospital, Englewood, N. J.
Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

Central New York Roentgen Ray Society
Secretary, Dr. Robert C. Hall 258 Genesee St., Utica, N. Y.
Three meetings a year—January, May and November.

Pennsylvania Radiological Society
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Next meeting, Penn. McKee Hotel, McKeesport, Pa., May 13–14, 1931.

Philadelphia Roentgen Ray Society
Secretary, Dr. Karl Kornblum, 3400 Spruce St.
Meeting first Thursday of each month from October to May inclusive, at 8:15 p.m., in Thomson Hall, College of Physicians, 19 S. 22d St.

Rochester Roentgen Ray Society, Rochester, N. Y.
Secretary, Dr. Camp C. Thomas, 476 Lake Ave.
Meets monthly on the first Friday evening at 7:45 at the Rochester Medical Association Building.

St. Louis Roentgen Club
Secretary-Treasurer, Dr. L. R. Sante, Missouri Building.
Meets first week of each month. Time and place of meetings designated by president.

Texas Radiological Society
Secretary-Treasurer, Dr. C. P Harris, Houston, Texas.
Meets annually one day preceding the meeting of the Texas State Medical Association.

University of Michigan Roentgen Ray Society
Secretary, Dr. D. M. Clark, University Hospital, Ann Arbor, Mich.
Meets every Wednesday evening from September to July, at 7:30 o'clock in the amphitheatre of the University Hospital.

* Secretaries of societies not here listed are requested to send the necessary information to the Editor.

Virginia Roentgen Ray Club
Secretary, Dr. Wright Clarkson, 205 S. Sycamore St., Petersburg, Va.
Next meeting, to be announced.

Cuba

Sociedad Cubana de Radiologia y Fisioterapia
Secretary, Dr. Francisco Padron, Enrique Villuendas 64, Havana, Cuba. Meets monthly in Havana.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Meets on the third Thursday of each month, from November to June inclusive, at 8:15 P.M., at 32 Welbeck St., London, W. 1., or as advertised.

Electro-Therapeutic Section of the Royal Society of Medicine (Confined to Medical Members)
Meets on the third Friday of each month during the winter at 8:30 P.M. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

Section of Radiology and Medical Electricity, Australasian Medical Congress
Secretary, Dr. H. M. Cutler, 139 Macquarie St., Sydney, New South Wales.

Radiological Section of the Victorian Branch of the British Medical Association
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

Section on Radiology, Canadian Medical Association
Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.

Radiological Section, New Zealand British Medical Association
Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch. Meets annually.

Continental Europe

Belgian Society of Roentgenology
Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

Societe de Radiologie Médicale de France
Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

Société Suisse de Radiologie (Schweizerische Röntgen-Gesellschaft)
Secretary for French language, Dr. A. Grosjean, La Chaux de Fonds.
Secretary for German language, Dr. Scheurer, Molzgasse, Biel.
Meets annually in different cities.

Société Francaise d'Electrothérapie et de Radiologie Médicale.
Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

Association of German Roentgenologists and Radiologists in Czecho-Slovakia
Secretary, Dr. Walter Altschul, German University, Prague, II/52.

Deutsche Röntgen-Gesellschaft (Gesellschaft für Röntgenkunde und Strahlenforschung)
Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.
Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

Süd- und Westdeutsche Röntgengesellschaft
Meets annually in different cities.

Nord- und Ostdeutsche Roentgengesellschaft
Meets annualy in different cities.

Dutch Society of Electrology and Roentgenology
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

Societa Italiana Radiologia Medica
Secretary, Professor M. Ponzio, University of Turin, Turin.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Nicolae Busila, 44 Elizabeta Blvd., Bucarest.
Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson.
Meets annually.

Leningrad Roentgen Ray Society
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly, first Monday at 8 o'clock, State Institute of Roentgenology and Radiology, Leningrad.

Moscow Roentgen Ray Society
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

Polish Society of Radiology
Secretary, Dr. Jan. Kochanowski, 45 Gornoslazka St., Warsaw. Meets annually.

Warsaw Section, Polish Society of Radiology
Secretary, Dr. B. Krynski, 11 Zielna St.
Meets once a month except in the summertime.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with exception of the Denmark Society, meets every second month except in the summertime:

Society of Medical Radiology of Sweden
Meets in Stockholm.

Society of Medical Radiology in Norway
Meets in Oslo.

Society of Medical Radiology in Denmark
Secretary, Dr. O. Wissing, Copenhagen.
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

Society of Medical Radiology in Finland
Meets in Helsingfors.

Vienna Society of Roentgenology
Secretary, Professor Holzknecht, Vienna, IX, General Hospital.
Meets first Tuesday each month, October to July.

Orient

Japan X-Ray Association
c/o Orthopedic Surgery, Tokyo Imperial University.
Meets annually in April.
Next meeting to be held April 1, 1931.

Kinki Roentgen-Abend Society
Director, Dr. Prof. Taiga Saito, Ogawaoike Tyoto, Japan. Meets bi-monthly on third Sunday.

TESTIMONIAL DINNER IN HONOR OF DR. JAMES EWING

On January 31, about 400 physicians, surgeons, and laymen gathered at the Hotel Pierre, in New York, to attend the testimonial dinner given by the Medical Board of the Memorial Hospital in honor of Dr. James Ewing. Dr. George Stewart was toastmaster. The speakers were: Surgeon General Hugh S. Cumming, "Dr. Ewing's Influence on Public Health Problems;" Dr. Howard Kelly, "Dr. Ewing's Contribution to American Medicine;" Dr. Livingston Farrand, "Dr. Ewing in Relation to Cornell University;" Dr. G. Canby Robinson, "Dr. Ewing's Contribution to Medical Education;" Mr. Thomas M. Debevoise, "Dr. Ewing's Influence on the Education of the Public on the Cancer Problem;" Dr. C. C. Little, "Dr. Ewing's Activities in the American Society for the Control of Cancer;" Dr. John Hartwell, "Dr. Ewing's Service to Surgery;" Dr. James Murphy, "The Influence of Dr. Ewing on Cancer Research;" Mr. Archibald Douglas, "The Influence of Dr. Ewing in the Development of Memorial Hospital;" Dr. Francis Carter Wood, "The Future Memorial Hospital;" Dr. Burton J. Lee, "Reading of Excerpts from Testimonials to Dr. Ewing;" Dr. Frank E. Adair, "Presentation of the Volume 'Cancer',—an International Tribute in Honor of James Ewing."

The dinner was characterized by the sincere affection of all those present for Dr. Ewing as a man, their high regard of him as a scientist and teacher. Dr. Ewing's versatility was brought out by the speakers of the evening; the spread of his fame by the many telegrams and letters received from all parts of this country and from Europe, among which may be mentioned those from President Hoover, Governor Roosevelt, Secretary Wilbur; Madame Curie and Professor Regaud of Paris. Dr. Ewing's preëminent position in the field of cancer research and therapy was aptly brought out by one of the speakers who said that whenever any new thing in cancer appears and hangs in the balance, everyone asks, "What does Dr. Ewing think about it?"

The dinner was arranged primarily for the formal presentation to Dr. Ewing of an illuminated copy of the January issue of the *Annals of Surgery*, which was dedicated to Dr. Ewing. Forty-six specialists of international reputation contributed to this volume on cancer as a tribute to Dr. Ewing.

In response to the speeches of the evening, Dr. Ewing spoke with evident emotion and his customary eloquence. With characteristic modesty he divested himself of all credit for his accomplishments. He stated that he had had the good fortune of coming in contact with some great men who had influenced him markedly. Continuing, he said: "I have long wished for an opportunity to acknowledge my debt to these strong men. Having enjoyed such rare associations, if my work has merited in the slightest degree the words spoken this evening, I can accept them only as a tribute to the lives and influence of the strong men whom I have known and whose confidence I have enjoyed. And now, if there is any portion of these honors of which I have not divested myself, I assign them to you, my friends, to each and every one of you here present this evening, and absent friends, who during these many years have given me the cheery salute, the timely caution, the helpful thought."

Dr. Ewing is well known to radiologists through his work on cancer and his keen interest in radiation therapy. In this field he is recognized as the outstanding figure in America. Dr. Ewing's active interest in radiation therapy dates back to 1913, when he became associated with the Memorial Hospital. It may be of interest to recall that this hospital was originally founded in 1884 as a cancer hospital by a group of prominent New Yorkers. But in those days no one wanted to go to a cancer hospital and so it became a general surgical hospital. In 1913 Dr. James Douglas, a philanthropist of great vision, felt that the time was ripe for the establishment of a cancer hospital provided with all known means of fighting cancer, and suitable laboratories for further research. Through Dr. Douglas's interest and generosity the Memorial

Hospital became affiliated with Cornell University Medical College and reverted to its original state of a cancer hospital. Dr. Douglas also provided the means for the gradual acquisition of four grams of radium.

At that time Dr. Ewing became the active head and guiding spirit of the Memorial Hospital as President of the Medical Board and Director of Cancer Research. It may safely be said that whatever success the hospital has had in its special field is due entirely to Dr. Ewing's leadership in its critical period after 1913. The writer has some vivid recollections of Dr. Ewing's skillful, eloquent, and forceful exposition of the merits of radiation therapy at the weekly conferences, at a time when only hopeless cases were regarded as suitable for radium and roentgen therapy. Through Dr. Ewing's persistent insistence on "giving radiation a chance," and the great weight which his word carried, it became possible at the Memorial Hospital to extend the use of radiation in the treatment of cancer so that soon its value was definitely demonstrated.

This indirect contribution of Dr. Ewing to the development of radiology in America overshadows perhaps the more direct contributions, such as his study of radiosensitivity. But, after all, this is in keeping with his innate modesty. Dr. Ewing will suggest a problem to one of his followers, and will make it possible for the latter to solve it, but he will never claim any credit for the work. There is nothing that gives him greater pleasure than to see a man in whom he is interested crowned with success.

G. FAILLA

ROENTGENOLOGICAL CONFERENCE

The roentgenologists attending the recent Roentgenological Conference (New England Roentgen Ray Society, New York Roentgen Society, Philadelphia Roentgen Ray Society, the Roentgenologists of Baltimore, the Roentgenologists of Washington, D. C.) were the guests of the Baltimore Roentgenologists on February 6 and 7, 1931. An extremely interesting and varied program was given at the Johns Hopkins Hospital, at the University of Maryland Hospital, at Mercy Hospital and the Howard A. Kelly Hospital. Members of the staffs of the various hospitals participated in the program. From a perusal of the program given below one may readily appreciate the variety of clinical subjects discussed. In addition to the members of the various societies which compose the Conference there were a great number of invited guests. Altogether about 250 attended the Conference. On Friday evening a banquet was given at the Lord Baltimore Hotel and Dr. Baetjer was toastmaster at this banquet. It was a very delightful evening and altogether the Conference was quite stimulating and instructive. This Conference, which began in a very modest manner as a sort of intercity conference among eastern roentgenologists, has grown to considerable proportions as may be judged from the number who attended the recent Conference.

On Friday morning, February 6, the meeting was held in the medical amphitheatre of the Johns Hopkins Hospital, with Dr. F. H. Baetjer presiding. The following demonstrations and papers were given: "Treatment of Chronic Osteomyelitis by Maggots" by Dr. William S. Baer; "Demonstration of Patient with Upper Mediastinal Tumor Mass Compressing the Superior Vena Cava" by Dr. Warfield T. Longcope; "Arteriovenous Aneurysms" by Dr. Dean Lewis; "Aspects of Rickets of Especial Interest to Roentgenologists" by Dr. E. A. Park; "X-Ray Burns and Their Treatment" by Dr. John S. Davis; "A Case of Unusual Bone Dystrophy" by Dr. L. Kajdi; "Hodgkin's Disease of the Bones" by Dr. Richard Dresser; "A Circle X-Ray Machine for Pneumo-encephalography and Some Results of Its Use. A Cinematographic Demonstration" by Dr. A. H. Pirie.

On Friday afternoon, the meeting was held in the chemical amphitheatre of the University of Maryland Hospital, with Dr.

Henry J. Walton presiding. The following program was given: "Unusual Visualization by the Ingested Barium Meal" by Dr. Howard E. Ashbury; "Paget's Disease" by Dr. John Evans; "Diaphragmatic Hernia" by Dr. Arthur M. Shipley; "Hernia of the Mediastinum" by Dr. Charles C. Habliston; "Cholestero-thorax" by Dr. Harry M. Stein; "The Roentgen Examination of the Lungs from the Standpoint of Tuberculosis in Industrial Medicine" by Dr. Gordon Wilson; "Osteochondroma of the Shoulder" by Dr. Charles R. Edwards; "Pyelitis of Pregnancy. Pyelovenous Backflow" by Dr. J. Mason Hundley, Jr.; "Roentgenological Cephalometry and Pelvimetry" by Dr. Henry J. Walton; "The Roentgen Ray in Obstetrics" by Dr. J. M. H. Rowland.

On Saturday morning, February 7, the meeting was held at Mercy Hospital, with Dr. Albertus Cotton as Chairman. The following program was given: "Clinical Significance of Roentgenological Findings in Chronic Appendicitis" by Dr. Julius Friedenwald; "Cholecystography by Mouth" by Dr. Alexius McGlannan; "Perforation of Simple Ulcer of the Colon" by Dr. Walter D. Wise; "Supernumerary Kidney with Opening into the Vagina" by Dr. Abram S. Samuels; "Clinical Roentgenology of the Genitourinary Tract" by Dr. A. J. Gillis; "Clinic on Pneumonia and its Complications" by Dr. Maurice Pincoffs; "Aneurism of the Heart" by Dr. Harry L. Rogers; "Bone Tumor of the Femur" by Dr. Albertus Cotton.

On Saturday afternoon the program was furnished by the staff of the Howard A. Kelly Hospital. A demonstration of apparatus and methods of radiation therapy with presentation of patients was given by Dr. Howard A. Kelly, Dr. Curtis F. Burnam, Dr. William Neill and Dr. Edmund Kelly.

PRESTON M. HICKEY MEMORIAL LIBRARY

To the Editor:

Soon after the death of Dr. Preston M. Hickey a movement was started to establish some sort of a memorial to this leader in the field of roentgenology. After due deliberation the idea of a "Preston M. Hickey Memorial Library" was considered most feasible.

As Dr. Hickey had in his last years developed an organization for post graduate training in roentgenology at the University Hospital, Ann Arbor, that department has been selected as the location for such a library.

Mr. W. W. Bishop, Librarian of the University will accept and combine such a collection of books with the Medical Section of the general library, have them catalogued and listed and maintain an exchange in case of duplication. This can be done and still allow the library to be within the Department of Roentgenology for use of the staff and students. Dr. Hickey had hoped to establish such a reference library.

The men trained under Dr. Hickey and those of his colleagues who know of the plans have signified their willingness to donate one or more volumes to this project. I am writing this letter in order that you may give it editorial comment if you so desire.

We feel that there are numerous friends of Dr. Hickey who would like to join in this effort but it would be rather difficult to reach them except through the medium of radiological publications. We are sending a letter to the Editor of each journal and asking that if he mentions the attempt which is being made in behalf of this memorial he request anyone who cares to donate to communicate with Mr. W. W. Bishop, Librarian at the University of Michigan, Ann Arbor.

S. W. Donaldson

Editor's Note: The above letter from Dr. Donaldson, the secretary of the Preston M. Hickey Club, will be of interest to the many friends of the late Dr. Hickey, and no more suitable memorial could be made than this which is being fostered by the former students of Dr. Hickey. It is to be hoped that those who are interested in the movement will communicate either with Dr. Donaldson or with Mr. W. W. Bishop, Librarian at the University of Michigan.

EDITOR'S NOTE: A recent editorial which appeared in the *New York Law Journal* (Feb. 3, 1931) is of considerable interest to roentgenologists and it was thought appropriate that this editorial be reprinted in full.

TORTS—PHYSICIANS AND SURGEONS—INJURY AND SORES FROM X-RAY

A physician or surgeon is bound to have the knowledge and skill ordinarily possessed by members of his profession. In a particular case he is bound to exercise all ordinary care and prudence in the use of that knowledge and skill in the treatment given to his patient (Antowill v. Friedmann, 197 App. Div., 230, 188 N. Y. Supp., 777; Sweeney v. Erving, 35 A. D. C., 57). The physician, in accepting employment, of course does not impliedly guarantee a cure, but is bound only to employ that degree of skill ordinarily possessed by practitioners generally under like circumstances.

This rule applies to x-ray treatment by a specialist (Antowill v. Friedmann, supra). In the last cited case, in an action brought against an x-ray specialist for injuries to a patient in treating her, an instruction that the result of the treatment in the particular case, namely, the sores caused by it, may be regarded as some evidence of negligence on the part of the physician, was held to be erroneous in view of proof that that result might follow from entirely proper treatment without any negligence. This is the case where the patient is hyper-sensitive to the x-ray, it appearing that about one person out of every 200 to 300 is thus hyper-sensitive, and which fact cannot be known in advance of the test of actual treatment and its results. In the Antowill case (supra) the late Justice Mills, writing for the unanimous Appellate Division, Second Department, in ruling that the instruction that the sores might be regarded "as some evidence of negligence" was legally incorrect, said as follows: "In my judgment that instruction was erroneous. It having been proven that that specific result might come from proper treatment without negligence on the part of the physician—that is, in a case of a hyper-sensitive person—the mere fact that that result did follow the treatment in this case was in itself no evidence of negligence. The case thus presented was merely one where according to the proof, the stated result might have followed from the one cause, viz, defendant's negligence, or from another cause, viz, plaintiff's hypersensitiveness, and therefore the naked fact of that result was in itself no evidence of the existence of the one cause in preference to that of the other."

A discussion of this subject, citing the foregoing New York decision, is found in the opinion of the Supreme Court of Iowa in the recently decided case of Berg v. Willett (232 Northwestern Rep., 821, Advance Sheets of December 10, 1930). In that case a patient received a severe burn on his hand as a result of x-ray treatments for the cure of ringworm on the hand. It was claimed that this burn resulted in permanent impairment of the use of that hand. The court ruled that the res ipsa loquitur doctrine did not apply. It was also stated that the unfortunate result from the treatments was not per se evidence of negligence or the want of skill on the part of the surgeon, but that this result might nevertheless be considered by the jury, together with the other facts and circumstances disclosed by the evidence, in determining whether the result might be attributed to negligence or lack of skill. The trial court had directed a verdict for the defendant. On plaintiff's appeal this was reversed on the ground that the issue should have been submitted to the jury. Stevens, J., writing the following opinion in part for the unanimous Iowa Bench:

"It is quite vigorously contended by appellee that the unfortunate result from the treatments is not in itself evidence of negligence or the want of skill on his part. This is the general rule applied in many cases in this state (Bowman v. Woods 1 G. Greene, 441; Almond v. Nugent, 34 Iowa, 300, 11 Am. Rep., 147; Smothers v. Hanks, 34 Iowa, 286, 11 Am. Rep., 141).

"As the view we take of the case eliminates the question of res ipsa loquitur, we express no opinion as to its application in other cases.

"The burden in this case was upon appellant to make out a case of negligence or unskillfulness by the preponderance or greater weight of the evidence. The physician does not in excepting employment impliedly guarantee a cure in any case or of any disease. He is bound only to employ that degree of skill ordinarily possessed by practitioners generally under like circumstances in the locality in which he practices his profession. It is, however, one thing to say that an adverse result is not in itself evidence of negligence or want of skill on the part of a physician, and another to combine the result with other facts and circumstances in determining the fact question. We think it is and must be the rule that while the result is not in itself evidence of negligence, yet same

may nevertheless be considered, together with other facts and circumstances disclosed by the evidence in a given case, in determining whether or not such result is attributable to negligence or want of skill.

"We said in Shockley v. Tucker (127 Iowa, 456, 103 N. W., 360) that: 'We think the fact that plaintiff was severely burned is some evidence in itself that the treatment was improper, and it cannot be said that the verdict lacks support in this respect in the evidence' (see also Rulison v. X-ray Corp'n, supra). This is the rule announced in a few other jurisdictions (Sweeney v. Erving, 35 App. D. C., 57, 43 L. R. A., N. S., 734; Antowill v. Friedmann, 197 App. Div., 230, 188 N. Y. S., 777; Lett v. Smith, 6 La. App., 249).

"It is admitted by all of the expert witnesses who testified in this case that the condition of appellant's hand would not ordinarily at least follow the skillful and careful application of x-ray treatments thereto. No witness testified that this is absolutely and necessarily true. The agreement between them is general that such result would not be expected to follow, and ordinarily would not do so.

"It was well said by Judge Taft, when circuit judge in Ohio, in Ewing v. Goode (C. C., 78 F., 442, 444) that: 'When the burden of proof is on the plaintiff to show that the injury was negligently caused by defendant it is not enough to show the injury, together with the expert opinion that it might have occurred from negligence and many other causes. Such evidence has no tendency to show that negligence did cause the injury. When a plaintiff produces evidence that is consistent with a hypothesis that the defendant is not negligent, and also with one that he is, his proof tends to establish neither.'

"Appellee denied that he gave appellant sixty treatments, supporting his testimony by the record and books of account kept in his office. Some treatments, as we understand the record, were applied to the right hand. According to the testimony of appellee but nineteen treatments in all were administered. The books of appellee showed that appellant paid him $83 and not over $200, as claimed by appellant. The evidence was ample to show that a patient may become susceptible to x-rays if the treatments are administered too frequently and over too long a period of time, resulting in an overdosage thereof. In such case the condition of which appellant complains may follow. Omitting all reference to the technical medical terms found in considerable number in the record, and without reviewing the evidence in detail,we think the jury might have found therefrom that appellee was negligent in applying x-rays to appellant's hand too frequently and perhaps over too long a period of time, thereby resulting in what is known as a cumulative dose or an overdosage. There is no evidence that the x-ray machine was negligently manipulated or that any particular application was in itself harmful. The case rests upon the claim of appellant that there was overdosage. No other theory accounting for the result is advanced by the experts, except the possibility that a burn may be attributable to some cause which could not have been known or anticipated in advance by the appellee. There can be no question under the evidence in this case that adverse results sometimes follow the administration of x-rays notwithstanding the operator may have exercised a high degree of skill and care in administering the treatments. In determining the course to the pursued all agree that much must necessarily be left to the judgment of the physician.

"The close and difficult question in this case is, therefore, whether the evidence of the expert witnesses presents facts upon which the jury could have based a verdict in favor of appellant for some amount in damage. No doubt the record leaves some room for speculation on the part of the jury. It seems to us, however, that a proper analysis of the record as a whole affords sufficient facts for the jury, without undue or unnecessary speculation, to have found that appellee was guilty of negligence and unskillfulness proximately resulting in the injury complained of. The burden imposed upon appellant was not to produce evidence of such a conclusive character as to exclude every other possible hypothesis than that appellee was negligent or unskillful in the treatment of the disease. The record in this case on the part of appellant does not present one hypothesis on which appellee was not negligent and another on which he was. In other words, the testimony in his behalf does not prove two equally probable theories.

"We reach the conclusion that appellant made out a prima facie case of negligence or unskillfulness on the part of appellee in the treatments administered, and that this issue should have been submitted to the jury."

DEPARTMENT OF TECHNIQUE

Department Editor: Robert B. Taft, 105 Rutledge Ave., Charleston, S. C.

HISTORY OF DIAPHRAGMING ROENTGEN RAYS BY USE OF THE BUCKY PRINCIPLE*

By HOLLIS E. POTTER, M.D.
CHICAGO, ILLINOIS

THE step by step evolution of the present forms of grid diaphragm apparatus has never been set forth in a manner that gives the young roentgenologist of today a good idea of the difficulties encountered by the older workers before the days of the Coolidge tube, the duplitized film and the intensifying screen. Up to the time of Bucky's article in 1913, all workers recognized and hated the dire effects of scattered rays but uniformly attributed them to some peculiarity in action of the roentgen-ray tube. As a background for succeeding articles in this Journal and for the information of persons in Germany who are now trying in every way to discredit the original work of Bucky, such a historical sketch seems justified.

While physicists at that time were aware of the presence, the direction, and the characteristics of scattered rays within materials, roentgenologists insisted that their plate fog had its origin in the tube as "extra-focal rays," "glass-wall rays," "inverse currents," etc. It is interesting in passing to note the devices intended to reduce these obnoxious rays to a minimum.

1. Circular, square and other simple diaphragms, placed below the tube, later combined with lead-lined cones as developed by Albers-Schönberg who also compressed the part to immobilize it and make it thinner. Hickey and others devised special forms of cone to further increase their efficiency.

2. The "Moving Slot" diaphragm of Pirie,[3] described in this Journal in September, 1913. Here a piece of flat lead containing a transverse slot was moved beneath the tube so that a narrow beam of x-light exposed a film from top to bottom in successive strips during the motion.

3. The "Double Slot" method of Cole, in which a second piece of flat metal containing a larger transverse slot was placed beneath the patient and moved with the upper slot of Pirie so as to protect the plate wherever not exposed to direct rays.

4. The writer's moving grid complex oscillating beneath the tube, shown at the Detroit meeting in the Winter of 1915.[4]

5. The "Hooded Target" of Coolidge. Here by a metal shield about the focal spot the number of extra-focal rays were reduced so that the tube efficiency was said to be improved several per cent.

These devices for eliminating film fog were not without value but their effects were misinterpreted. It was not understood that any restriction in the size of the roentgen-ray beam reduces fog on the film mainly because it fails to excite the number of scattered rays within the body that are excited by a larger beam. An estimation of the quantitative value of diaphragming below the tube was first given out by Wilsey[10] in January, 1922. He shows for instance that a circular diaphragm allowing an image diameter of 1.5 inches has the same efficiency in removing scattered radiation as a grid diaphragm of slit ratio 1 to 5 placed beneath the patient. Under ordinary working conditions this circular opening would be scarcely larger than one-fourth inch in diameter.

The new explanation for film fog and scattered radiation assumed and then proved in the article of Gustav Bucky first

* This is the first of a series of articles by the same author on diaphragming roentgen rays. The title of the article for April is: "Principles underlying the Grid Diaphragm which Limit its Form and Efficiency."—Ed.

published in English in the *Archives of the Roentgen Ray*, June, 1913, was revolutionary for the roentgenologist. His article was entitled "A Grating Diaphram to Cut off Secondary Rays from the Object." In the body of the article he called his device a "Gitter-Blende." His description follows:

> This consists of a series of metallic strips from two to four centimetres in width, forming a sort of grating, and so arranged that the plane of each one is exactly parallel to the x-ray beam falling upon it. These strips, or fins, act as a screen, allowing the x-rays to pass, but cutting off all rays which are not parallel to the primary x-ray beam. On the photographic plate the shadow of the fins will be mere narrow lines, with an appearance as if a wire-netting had been stretched over the plate. Each mesh of this netting plays the part of a minute diaphragm cylinder, so short that it will not interfere to any great extent with the quality of the negative. I found this "grating-diaphragm" to be perfectly satisfactory, thus demonstrating the truth of my theory that the fogging is due to the secondary object-radiations. I found that with the grating diaphragm, and the object four centimetres from the plate, I could obtain a negative much sharper than that obtainable without the diaphragm and with the plate and the object in absolute contact.

Again he says:

> The network of white lines on the negative is of no disadvantage, but rather the contrary, since it may be used for the accurate measurement of the various organs, and further, it should be noted that with this diaphragm the time of exposure is increased by about 25 percent

In America roentgenologists have considered this article as the original announcement as to the rôle of scattered rays in roentgenography, first proved by their visible absorption within the metallic walls of the Bucky grating. I have been well in touch with the writings and the rumors throughout the development of grid diaphragms and know of nothing in America to precede the article by Bucky in 1913.

Bucky's grating, however, found no practical place in roentgenography. Here and there during the following years one could be found in the experimental junk heap of inquiring roentgenologists. Each and every test with his grating carried positive conviction as to the origin and possible suppression of the harmful vagabond rays but the shadow structure of the grating itself was too pronounced to be tolerated. In the Summer of 1914 Germany engaged in a war which was waged continuously to November, 1918. During this time Bucky and his grid were no more heard from on this side.

During the period from 1913 to 1917, I was one of several who designed and experimented with grid diaphragms in the hope of making the Bucky principle practical for routine use. Briefly the stages covered in my work were as follows:

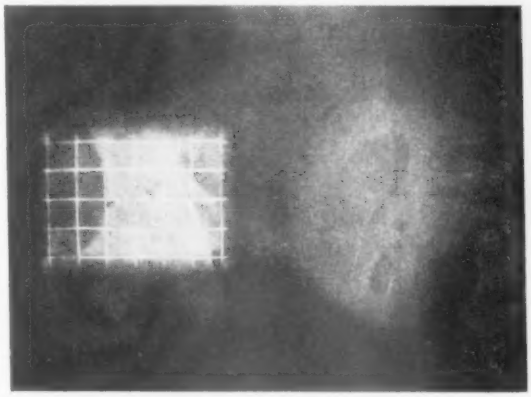


Fig. 1. From *Archives of the Roentgen Ray*, June, 1913.

At the Detroit meeting of the Central Section of the American Roentgen Ray Society, in February, 1915, there was shown a tubular grating of the Bucky type adapted for use below the tube and another below the patient. Both were arranged to move in a linear direction along or nearly along the diagonals of the squares. Moved in this manner the troublesome shadows of the metallic intersections were at a minimum. At the same time five general laws were laid down which must be satisfied in order that moving grids shall be rendered invisible on the roentgen plate. This article appeared in our Journal for March, 1916, "Diaphragming Roentgen Rays."[4]

In September, 1916, at the annual meeting of the American Roentgen Ray Society at Chicago, a second contribution was entitled, "The Bucky Diaphragm Adapted to Fluoroscopy."[5] This discussed a rotating circular disc grid with strips placed radially. Upon rotation between patient and screen at proper speeds the peripheral portion of this grid absorbed scattered radiation and the metallic strips were rendered less of a nuisance by motion.

In February, 1917, a mid-winter meeting of the Central Section was held in Cincinnati. By this time a long series of distressing experiments had caused me to abandon entirely for roentgenography all grid constructions which involved the crossing of metallic strips and to use only the parallel strips which fully satisfied the basic requirements for invisibility. A paper was read entitled "The Object Secondaries in Radiography—A Practical Working Method for Their Suppression."[6] The parallel strip curved grid apparatus such as is used today was shown, together with a dozen plates exposed through corpulent individuals. The following are paragraphs quoted from this paper, with introduction and other non-vital portions omitted:

The well-known Bucky grating consisting of numerous tubules of metal placed over the plate does this admirably. As pointed out previously the detracting shadows of the metal grating itself can be largely eliminated by a uniform motion along the diagonals of the squares. That the crossed type grating described by Bucky cannot completely neutralize its own shadows by motion was admitted for reasons set down under a formulated set of laws for invisibility of metal strips moving over plates during exposure. Since that time the author has been carrying on a series of experiments with other combinations of motion and construction to obtain, if possible, all the functions of the admirable grating of Bucky with a perfect and complete invisibility. This has been successfully accomplished.

By the general method shown at our last annual meeting by Dr. Shearer in which a photographic record of the scattered rays alone could be obtained under various conditions of absorption by metallic tubules, etc., I tested out some Bucky gratings against a series of filters made by not crossing the strips but running them parallel and closer together. It was surprising to find that the total amount of rays suppressed by the parallel system was about the same as in the Bucky crossed grating, and it is far easier to build them close together. It was also shown that when thin inch brass strips were spaced one-fourth inch apart, the filtering effect was practically as good as when spaced one-sixteenth inch apart. These results were considered very important from the standpoint of invisibility since they justified a parallel system of construction in which the strips could be assembled into the form of a portion of a cylindrical shell.

Accordingly an instrument was constructed of which a general idea can be obtained from figures A and B. The filter strips are mounted radially so as to form a portion of a cylindrical shell with the idea that the motion be along this same arc and across the strips. It is easily seen that with this construction there will result practically even illumination over a large area, that with a uniform motion the shadow of the strips will be neutralized and all requirements for invisibility satisfied in the simplest manner.

The motion must be a uniform one and does not need to be rapid . . . . The ratios were such that the filter unit moved half an inch a second for five inches . . . . The whole exposure should be made during one stroke.

Results: The results are highly gratifying for the demonstration of the lumbar spine, hip joints and pelvis and particularly for calculi. In several cases where small urinary calculi in portly individuals were difficult of demonstration the results obtained by the filter were so far superior as to justify almost any statement. In one case of intra-cranial bone tumor it aided materially in showing the spongy network within the tumor. Although at this writing no positive gall stone cases have been encountered the aid in this field cannot be doubted. With a suitably modified construction allowing a longer stroke and a higher speed, gastrointestinal work might be improved.

This article was read before the meeting but never published on account of a visit soon after by Dr. Eugene Caldwell who stopped on his way to Kansas. During the

day's visit the conversation focused on the grid diaphragm problem and Dr. Caldwell was freely shown the results of experiments including the final development of the curved parallel grid in the hope that he would volunteer some information as to his experiments of which rumors were afloat. Since he remained silent and I cherished a secret ambition to "beat" him to the correct solution, a letter was sent immediately to Dr. Caldwell asking him point blank what results, if any, he had so far obtained. He answered by the following rather informative letter:

Dr. Hollis E. Potter March 8, 1917.
1410 Peoples Gas Bldg.,
Chicago, Illinois.
Dear Doctor:

In answer to your letter of February 27th., which reached me only a day or two ago, I have to say that immediately after the publication of the Bucky apparatus, I conceived the idea of moving the screen to get rid of the shadows of the grid, and did a little experimenting in this direction. At the same time, I looked up the patent question and found that Bucky himself had described about every possible means of moving the screen for this purpose. I found also that there was a German patent which covered particular forms of the moving grid which are similar to those you have used. I am unable to get a copy of this German patent but I send you herewith a copy of Bucky's United States patent, application for which was filed February 3, 1914, and of my patent, application for which was filed October 12, 1915. You will see that my patent refers to a time switch in connection with an automatic device for moving of Bucky screen through a very small space. So far as my patent is concerned, it has no relation whatever to your work. The Bucky patent probably covers everything that you have done.

I think that these patents need not deter you in the least from any experimentation you wish to do if you care to repeat work that has already been done. It is so easy to find out from the patent office what has been done in such a case that I think we should really investigate this before publishing work as our own.

I am just a little sensitive over the criticism that has been made in regard to patents granted to me. Most of this criticism I think is due to ignorance, but some of it seems to be malicious. About all the patents have ever done for me is to establish a date and to give proof of priority. I have felt that anything upon which the patent office would allow me a patent, was very likely original with me. In a great many instances the patent office has informed me that devices which I supposed were new and original with me, were really very old.

There is no money to be made out of patents on such x-ray devices. One does not even recover the cost of doing the development work and experimentation. Theoretically, at least, one benefits his colleagues by patenting anything useful that he may develop, because he is then able to insist that any maker who undertakes the construction of these devices shall make them well and also because it should be easier to induce a maker to manufacture a patented article, the sale of which he cannot control. The insinuation that has sometimes been made, to the effect that one patents such a device for the sake of preventing his colleagues from using it or in order to accumulate wealth by taxing his colleagues for royalties, is of course absurd. One's colleagues seldom appreciate the amount of labor and expense necessary to develop even a simple device to a point where it can be manufactured.

Yours very truly,
(signed) E. W. Caldwell.

I was amazed and somewhat taken aback by the letter and the two patents included therewith. Caldwell's silence during his visit had resulted, of course, from his natural reticence and a desire to injure no one's feelings. The letters patent were read at length and were particularly interesting in that they showed the fact that at least three experimenters had traversed about the same routes up to a certain point. Up to this time I had never heard that Bucky had conceived the idea of making the grid invisible by movement and had only heard rumors that Caldwell was working on the Bucky diaphragm principle.

This disillusionment meant of course that it would be unfair to speak or write further on the grid diaphragm until the close of the war. Experiments could go on and apparatus be perfected but Bucky should be given every chance to show any

experimental results or any practical working apparatus. Caldwell should be given opportunity to enlarge upon his work.

Bucky's claims were rather broad but specifically favored a cross-grid construction as most advantageous. He showed in detail a mechanism for moving this grid "so that each point in said grid will describe a circular path" and distinctly specified that the diameter of the circle of motion should be just equal to the length of the side of the smallest squares of the grid. He makes his claims broad by mentioning other forms of grid construction and in a sweeping manner assumes that their proper movement will result in an absence of grid shadows on the plate. No attempt is made to prove that the circular movement of a flat crossed grid will result in its invisibility, but he makes this dashing statement, "The velocity of the drive must be such that the walls of the grid will not cast a visible shadow upon the photographic plate or upon the fluorescent screen." The required velocity is not mentioned.

It has proved unfortunate for Bucky that he did not accompany his patented ideas with such experiments as would lead to a true solution of "invisibility" in the use of his admirable grid principle. It would seem to me that his patent was couched in terms broad enough to cover almost anything, but the Austrian Patent Court has ruled that his claims cover only the honeycomb type of construction described at length in his patent.

Caldwell also favored a crossed grid but desired that it be moved in a linear direction corresponding to the diagonals of the squares, and makes claim for originality for a device which will stop the grid at points beyond the start equal to one or more diagonals. This, he says, will produce an equality of grid shadows over the entire plate. The "start-and-stop" device was combined with an arrangement for closing the x-ray circuit at "start" and opening it again at "stop."

Thus on March 8, 1917, I was somewhat rebuked by Caldwell for a lack of information regarding the proceedings of the Patent Office. The usual channels of medical and roentgen literature could not be depended upon for the latest in experimental advance but only the legal department. Never having seen a patent or talked with a patent lawyer and not caring to become educated regarding them, I turned to other lines of experimentation, occasionally reverting to the problem of perfecting the

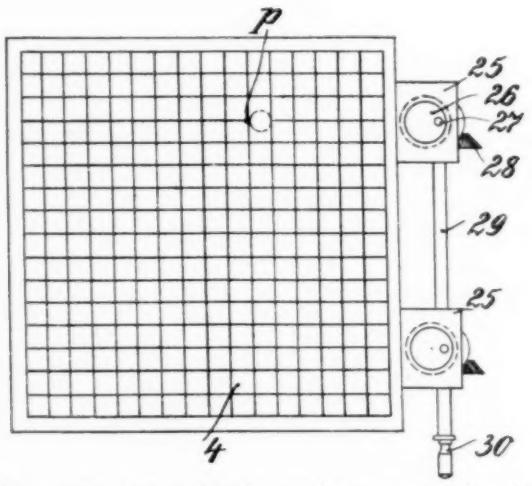


Fig. 2. Bucky's design for moving crossed strip grid. The bandle, 30, through shaft and gears actuates excentric, 26, causing the grid to move in a circular path of diameter shown at *p*.

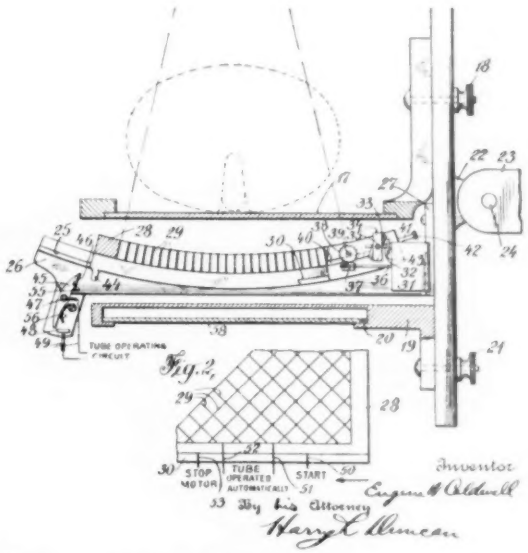


Fig. 3. Caldwell's start-and-stop mechanism for moving cross type grid along line of diagonals.

smooth action of the parallel slotted grid apparatus. It was Carl Lundberg, an assistant supplying vacancies during the war, who superintended much of the building of the first 14 by 17 model equipped with an oil dash-pot for smoothly regulating the motion.

This somewhat cumbersome model was used occasionally and started rumors. Directly after the mid-winter meeting of the Central Section in Chicago, February 22, 1919, Mr. Henry Engeln was consulted about building a special table to accommodate this unit. After seeing a series of plates made with it he rounded up a number of members whose trains East were not yet due and they stayed over for a private demonstration the following morning.

By this time, I had been able to find out that nothing in the way of practical progress had been made or reported by Bucky or others during the war. Immediately after the armistice Dr. Coolidge and Mr. Carl Darnell made a rather thorough survey of the roentgen-ray situation on the Continent. They reported that they could find no one using the grid principle except Albers-Schönberg who had a fixed cross-grid Bucky grating mounted for fluoroscopic work. Other visiting American workers soon reported the same.

I was placed in a position where it was beginning to look as if something were being held back from the profession. Numerous letters of inquiry were received urging that manufacturers make the apparatus available for general use. The silence maintained since the Caldwell letters no longer seemed justified. No one else working in this field of experiment had produced anything of practical value. Accordingly the Cincinnati article of February, 1917, was smoothed up and sent to this Journal where it was published in June, 1920, under the heading, "The Bucky Diaphragm Principle applied to Roentgenography."[6] Full cooperation was given any manufacturers who desired to furnish the device for public use. At the next annual meeting of the American Roentgen Ray Society, Minneapolis, September, 1920, several dozen films were displayed to accompany the paper, "The Bucky Diaphragm Principle applied to Radiography of the Spine," later published in this Journal.[7] At this meeting a slightly improved copy of the apparatus was shown by George W. Brady.

It was not until the perfection of duplitized film to the point where it could reasonably displace glass plates that grid diaphragms could be used with facility or even with safety. The excessive ray quantities overtaxed the gas tubes and the smaller capacity Coolidge tubes. Moreover a short series of adequate exposures through the same skin areas involved the use of an erythema dose when corpulent individuals were being handled. With the duplitized film and double screen technique made available in the first half of 1920 the grid diaphragm could and did become widely used.

Shortly after the public demonstration of the parallel type of moving grid diaphragm apparatus which manufacturers courteously called the "Potter-Bucky Diaphragm," the research department of the Eastman Kodak Company agreeably volunteered to make quantitative measurements of scattered rays as met with in ordinary working conditions and this was carried on by Dr. R. B. Wilsey in a most admirable and thorough manner. His results were published in these columns as follows:

"The Intensity of Scattered X-Rays in Radiography," June, 1921.[8]
"The Effects of Scattered X-Rays in Radiography," October, 1921.[9]
"The Efficiency of the Bucky-Diaphragm Principle," January, 1922.[10]

These articles give an exhaustive analysis of the quantities and values concerned in the suppression of scattered rays. They are in a form which appeals to the scientist and contain basic facts which must underlie any accurate conception of grid function. They stand as a handbook for anyone wishing to experiment with the form or efficiency of grid apparatus.

SUMMARY

The essential points in the history of diaphragming roentgen rays by the grid diaphragm are therefore:

1. The original announcement by Gustav Bucky in German and English roentgen-ray journals in 1913 of the valuable function of the metallic cellular grating.

2. The conception by Bucky, Caldwell, Potter and others, that some form of grid construction combined with some type of grid movement might neutralize or efface the shadows of the grid itself.

3. The writer's experimental demonstration that the constructions and movements favored by Bucky and Caldwell could not be made to result in invisibility but that parallel strip construction would do so when combined with a movement of the most critical uniformity.

4. The writer's experimental proof that parallel lead strips give approximately the same total scattered ray absorption as any form of tubular or cellular grating and could be constructed with greater ease and accuracy.

5. The writer's demonstration that for maximum flexibility of operation and with least probability of visible grid shadow formation the parallel strip complex should be curved to the form of a cylindrical shell, with center of curvature equal to the intended operating distance of the tube.

6. Wilsey's experimental measurement of scattered rays emerging from the deeper body tissues and the experimental proof of grid diaphragm efficiency in their absorption.

REFERENCES

1. Bucky, G. A grating diaphragm to cut off secondary rays from the object. *Arch. Roentg. Ray*, June, 1913.

2. Caldwell, Eugene. Personal communication to the author.

3. Pirie, A. H. A sliding diaphragm for improving the quality of skiagraphs. Am. Quart. Roentgenol., 1913, *5*, 18–19.

4. Potter, H. E. Diaphragming roentgen rays; studies and experiments. Am. J. Roentgenol., 1916, *3*, 142–145.

5. Potter, H. E. The Bucky diaphragm adapted to fluoroscopy. Am. J. Roentgenol., 1917, *4*, 47–50.

6. Potter, H. E. The object secondaries in radiography; a practical working method for their suppression. Read at mid-winter meeting of Central Section, American Roentgen Ray Society, Cincinnati, February, 1917. Not published. Published later under title: The Bucky diaphragm principle applied to roentgenography. Am. J. Roentgenol., 1920, *7*, 292–295.

7. Potter, H. E. The Bucky diaphragm principle applied to radiography of the spine. Am. J. Roentgenol., 1921, *8*, 61–65.

8. Wilsey, R. B. The intensity of scattered x-rays in radiography. Am. J. Roentgenol., 1921, *8*, 328–338.

9. Wilsey, R. B. The effects of scattered x-rays in radiography. Am. J. Roentgenol., 1921, *8*, 589–598.

10. Wilsey, R. B. The efficiency of the Bucky-diaphragm principle. Am. J. Roentgenol., 1922, *9*, 58–67.

BOOK REVIEWS

Books Received Are Acknowledged under Heading: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers as space permits.

Intestinal Tuberculosis: Its Importance, Diagnosis and Treatment. A Study of the Secondary Ulcerative Type. By Lawrason Brown, M.D., Consultant to the Trudeau Sanatorium, and Homer L. Sampson, Roentgenographer of the Trudeau Sanatorium, Saranac Lake, New York. Second edition, thoroughly revised. Cloth. Price, $4.75. Pp. 376, with 122 engravings and 2 colored plates. Philadelphia: Lea and Febiger, 1930.

The mere announcement of the publication of this book should be all that is necessary to insure a wide demand for it. Medical men have learned to attach great importance to any product of the Trudeau Sanatorium in the field of research as well as that of the practical handling of tuberculosis.

Those who own the first edition of "Intestinal Tuberculosis" know well the value of the work. The second edition retains practically all the valuable material of the earlier volume with numerous additions which further investigation and experience have shown to be worth while.

The intestinal manifestations of the disease are covered in all their aspects. The completeness of the work could be well shown only by a study of the table of contents with its twenty-eight chapters and subtitles. Both laboratory and clinical phases have been thoroughly dealt with. Roentgenologic diagnosis is given in considerable detail and at greater length than in the earlier edition, although a large portion of it is elementary and already familiar to the average roentgenologist. Everyone should profit by a review as well as by new variations in technique that are suggested.

Emphasis is laid upon the necessity for care, patience and persistency if accurate diagnoses are to be made. As the authors point out, few cases can be accurately studied by the usual procedure which employs only the immediate observation when the meal is ingested, the four or six hour study and the twenty-four hour examination. One is advised to see the patient roentgenoscopically at approximately the three, six, seven, eight, nine and twenty-five hour periods. Suggestions are given regarding the points to be noted at each roentgenoscopic study as well as the film findings at each period. Numerous tables and illustrations are included which should prove invaluable to the inexperienced worker.

The roentgenologist should of course be nearly as interested in the other portions of the book as in the roentgen section for only when he thoroughly understands the course of the disease as well as the morbid anatomy can he function as a good consultant for the internist.

Despite the all-inclusive nature of the work, subjects are treated concisely so that reading is not laborious. Short chapters facilitate reading at odd moments. The style and subject matter alike hold one's interest. Though numerous statistics are interspersed through the text they are handled in such a way as to prevent their becoming tiresome.

A very extensive bibliography adds to the value of the volume for those inclined to further study.

E. W. Hall

The National Physical Laboratory. Report for the Year 1929. Paper. Price, 11s. net. Pp. 298, with 58 illustrations. London: His Majesty's Stationery Office, 1930.

The section on Radiology, under the direction of Dr. G.W.C. Kaye, reports a very comprehensive program under way which may be divided into three distinct parts: x-ray metallography, radiological research, and pure physics research. The first embraces various investigations in x-ray crystal structure analysis, and it is to be noted that they do a large amount of cooperative work of this nature with other divisions of the Laboratory. They are also equipped to make roentgen analyses of metals. In connection with their radiological program, the National Physical Laboratory has established a standard roentgen-ray ionization chamber for the measurement of the "roentgen." Using this, the pastille B-dose has been standardized over the range of 50–100 kv. unfiltered radiation. There was no report of their having standardized secondary ionization chambers. Their new program calls for a high voltage rip-

ple potential generator which is now under construction. Among their pure research problems is an investigation on the intensity of scattered roentgen rays with the angle of scattering for a number of materials, covering a wide range of atomic numbers. This is also being done at various temperatures by the use of single crystals. An investigation of the "J" phenomena by the absorption method gave negative results, and the observations will be repeated at higher voltages. An investigation has been commenced on the energetics of roentgen-ray production. This will include a study of roentgen-ray output with variations in exciting voltage, target material, and the angles between cathode beam, target face and angle of roentgen-ray emission. The roentgen-ray protection work has included the inspection of an increased number of institutions employing roentgen rays. Their radium tests for the year also showed a large increase. In general it may be said that Dr. Kaye's program has expanded and developed in a most enviable manner and we should look forward in the future to the solution of many problems of interest and value to the radiologist.

Lauriston S. Taylor

Books Received

Cancer of the Lung and Other Intrathoracic Tumors. By Maurice Davidson, M.A., M.D., B. Ch. (Oxon.), F.R.C.P. (Lond.), Physician to the Brompton Hospital for Consumption and Diseases of the Chest, and Dean of the Brompton Hospital Medical School; Physician to the Miller General Hospital for South-East London; Consulting Physician to St. Luke's Hospital, Chelsea. Cloth. Price $5.50. Pp. 173, with 62 illustrations. New York: William Wood and Company, 1930.

Physics of Radiology. For the Student of Roentgenology and Radium Therapy. By J. L. Weatherwax, M. A., Physicist, Philadelphia General Hospital, Associate in Radiotherapeutic Physics, University of Pennsylvania Graduate School of Medicine. With a foreword by Henry K. Pancoast, M. D., Professor of Roentgenology, University of Pennsylvania. Cloth. Price, $5.00. Pp. 240, with 126 illustrations. New York: Paul B. Hoeber, Inc., 1931.

Practical Radiation Therapy. By Ira I. Kaplan, B. S., M.D., Director, Division of Cancer, Department of Hospitals, New York City; Attending Radiation Therapist, Bellevue Hospital. With a special chapter on Applied X-Ray Physics, by Carl Braestrup, B. Sc., P. E., Radiation Physicist to Mt. Sinai Hospital, New York City. Cloth. Price, $6,00. Pp. 354, with 227 illustrations. Philadelphia: W. B. Saunders Company, 1931.

Artificial Sunlight. Combining Radiation for Health with Light for Vision. By M. Luckiesh, D. Sc., Director, Lighting Research Laboratory, Edison Lamp Works—National Lamp Works, General Electric Company, Nela Park, Cleveland, O. Cloth. Price $3.75. Pp. 254, with 65 illustrations. New York: D. van Nostrand Company, Inc., 1930.

Normale Anatomie des Kopfes im Röntgenbild. II. Teil. (Radiologische Praktika, Bank XIII.) Von Universitäts-Assistent Dr. Karl Goldhamer, Leiter des Röntgenlaboratoriums an der I. Anatomischen Lehrkanzel (Prof. Tandler) in Wien. Cloth. Price, M. 120. With 44 photographic plates, 44 illustrative schemas and 26 projection diagrams. Leipzig: Georg Thieme, 1931.

Die Normale Entwicklung des Knochensystems im Röntgenbild. (Radiologische Praktika, Band XV.) Von Dr. E. Ruckensteiner, Assistent am Röntgeninstitut des Rudolfinerhauses, Vorstand Reg.-Rat Primarius Dr. W. Frhr. v. Wieser, Wien. Cloth. Price, M. 18.60. Pp. 79, with 63 illustrations, 11 curves and 3 tables. Leipzig: Georg Thieme, 1931.

Röntgentherapeutisches Hilfsbuch. Für die Spezialisten der übrigen Fächer und die praktischen Ärzte. Von Dr. Robert Lenk, Dozent für medizinische Röntgenologie an der Universität Wien. Mit einem Vorwort von Professor Dr. Guido Holzknecht. Fourth edition. Paper. Price, RM. 4.80. Pp. 85. Wien: Julius Springer, 1930.

The Origin of Lymphosarcomatosis and its Relation to other Forms of Leucosis in White Mice—Lymphomatosis Infiltrans Leucemica et Aleucemica. (*Acta radiol.*, Suppl. X.) By Karl Krebs, Hans Christian Rask-Nielsen and Aage Wagner. Paper. Price, Sw. cr. 8. Pp. 53, with 29 illustrations. Stockholm: P. A. Norstedt & Soner, 1930.

The National Physical Laboratory. Report for the Year 1929. Paper. Price, 11s. net. Pp. 298, with 58 illustrations. London: His Majesty's Stationery Office, 1930.

Atti del IX Congresso Italiano di Radiologia Medica. Parte I. Relazioni e conferenze. Torino 20–21–22 Maggio 1930 (Anno VIII). Paper. Pp. 352, with numerous illustrations. Modena: Tipografia Immacolata Concezione, 1930.

The American Journal of Cancer. January, 1931, Volume XV, No. 1, pp. 1–561. Editor, Francis Carter Wood.

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ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

NECK AND CHEST

Hampton, A. O., Bland, E. F., and Sprague, Howard B. Further studies of the aorta with special reference to luetic aortitis. *Am. Heart J.*, Oct., 1930, *6*, 77–81.

This paper presents the method used in the roentgenographic interpretation and measurements of the ascending and transverse portion of the thoracic aorta.

Standard teleroentgenograms are taken of each case studied with the patient in three positions: anteroposterior, right anterior-oblique and left anterior-oblique of which the latter has been found to be the most valuable. The tube-film distance is 7 feet, the exposure time should be as short as possible, preferably 1/10–1/20 of a second.

For the left anterior-oblique view, the patient is placed at an angle of from 40 to 50° with the central beam of the roentgen ray. The right anterior-oblique view of the aorta is made in much the same manner except that an effort is made to superimpose the ascending and descending aorta by rotating the patient in the opposite direction, the proper angle between the line of the shoulders and the central beam being approximately 30°.

Measurements of the supracardiac shadow obtained from the teleroentgenogram are made in the anteroposterior and left anterior-oblique views. The anteroposterior projection is measured by a transverse line across the widest point of the supracardiac silhouette above the region of the pulmonary artery.

Measurements of the aorta in a series of routine roentgenograms compared with the clinical findings seem to justify the deduction of a normal and abnormal average. The normal and arteriosclerotic ascending aorta without dilatation was found to average 5.3 cm. The arch averages 3.5 cm. unless the aorta is dilated.

The authors studied 89 cases, of which 15 were clinically diagnosed luetic. The method of study gave an average transverse diameter of 7.0 cm. and an arch diameter of 4.6 cm. They came to the conclusion that the dilated ascending aorta invariably measures over 6 cm. in diameter. The differential diagnosis in cases found by roentgen examination to have aortic dilatation depends upon clinical and other roentgen findings.—*F. K. Alexander.*

Kurtz, Chester M., and Eyster, J. A. E. Fluoroscopic studies of the heart and aorta in acquired and congenital syphilis. *Am. Heart J.*, Oct., 1930, *6*, 67–76.

The authors present a study of 54 cases of acquired syphilis and 12 cases of congenital syphilis with special reference to the roentgenoscopic findings in the heart and aorta. The criteria for a diagnosis of aortitis are: (1) elongation or tortuosity; (2) widening of any portion; (3) pulsation to the right of the sternum, and (4) increased density permitting visualization of the descending aorta, especially in patients under the age of fifty years.

Roentgenoscopic evidence of aortitis was found in 90.7 per cent of the cases of acquired syphilis and in 36.4 per cent of the cases of congenital syphilis. Aneurysm of the aorta was found in 18.5 per cent of the cases of acquired syphilis and was absent in all the congenital cases. Cardiac enlargement was present in 39.9 per cent of the cases of acquired disease.

In an interesting group of 23 cases of acquired syphilis exhibiting primarily central nervous system involvement, 95.7 per cent showed evidence of aortic disease, and aneurysm could be demonstrated in 21.8 per cent.—*F. K. Alexander.*

Steel, David. The roentgenological diagnosis of syphilitic aortitis; a review of forty proved cases. *Am. Heart J.*, Oct., 1930, *6*, 59–66.

The author reports a series of 40 cases of luetic aortitis observed roentgenologically and proved by autopsy. No case of aneurysm is included.

The differential diagnosis of the pathological aorta must include: the dilatation of atherosclerosis, advancing age, hypertension, aortic insufficiency and stenosis of the isthmus. A review of this series of cases gave the general impression that these lesions cannot be safely differentiated roentgenologically. Yet a diagnosis can be safely made when the lesion is well marked and this margin of safety increases no-

tably when the clinical facts are used. The author suggests that the roentgen diagnosis should always be accepted by the clinician "provided the history and physical findings agree or at least do not oppose."

The well-marked cases of syphilitic aortitis reveal the findings of a high, dense and prominent knob, a slight haziness in outline, an irregular and general dilatation and a cardiac silhouette consistent with aortic insufficiency. A generalized dilatation, unless excessive, is not in itself a pathognomonic sign for the roentgen diagnosis of syphilis, though a marked degree of generalized dilatation is more common in syphilis and can be taken as presumptive evidence, especially if the heart shadow is small or if it occurs in a person under forty.

Three cases in this group were considered and proved as an early aortitis with findings of an increase in the height of the knob with increased density. However, the author concludes that early syphilitic aortitis is not always demonstrable roentgenologically, though he believes that its earliest symptom is a localized dilatation.—*F. K. Alexander.*

Ingraham, Ruth, and Maynard, Edwin P. The electrocardiogram and teleroentgenogram in early syphilis. *Am. Heart J.*, Oct., 1930, *6*, 82–85.

The authors report a group of cases studied with the electrocardiogram and teleroentgenogram. The cases were carefully selected, only early cases of syphilis, a year or less, in which the date of the initial lesion was known were chosen. To exclude the changes due to age, the group was limited to patients under forty years. To rule out hypertension, no case was included with a systolic blood pressure over 140. Lastly, all patients were excluded who gave a history of any other disease that might affect the heart, including rheumatic fever, chorea and hyperthyroidism. The group consisted of 27 cases. Of these, 70.4 per cent gave electrocardiograms that fell within normal limits; 29.6 per cent showed a left axis deviation. A recent publication of the study of axis deviation in normal hearts showed 33 per cent of deviation to a normal or slight degree.

The examination of hearts by the teleroentgenogram was made in the anteroposterior position at a 6-foot target distance. The shadow measured for the aorta was that shadow seen immediately to the right and to the left of the spine in the region of the aorta. A total diameter of the heart, 50 per cent of the total diameter of the chest, was considered the upper limit of normal.

Of a total of 23 cases studied, 10 were normal throughout. In 6 there seemed to be slight enlargement of the ascending aorta.

Correlating the electrocardiographic with the roentgen findings, the authors found that in 6 cases of left axis deviation in which films were made, 3 were normal and 3 showed definite enlargement of the aorta. The 3 remaining cases of aortic enlargement gave normal electrocardiograms.

The authors concluded that of the cases studied the electrocardiograms and teleroentgenograms were not beyond the limits of normal deviation.—*F. K. Alexander.*

Ramsbottom, Albert. Inflammation of the diaphragm. *Brit. M. J.*, July 5, 1930, *2*, 5–7.

Excluding sympathetic fibers, the diaphragm receives branches from the phrenic nerve and the lower six or seven intercostal nerves. The former arises from the third, fourth and fifth cervical nerves, but mainly from the fourth. It is easily seen that diaphragmatic conditions refer pain to the lower thoracic wall and also to the shoulder, inasmuch as the phrenic arises from the same cord segment which supplies the skin of the supraclavicular region.

Diaphragmatic pleurisy is either acute, subacute or chronic. The first condition may simulate an acute abdomen, but the absence of abdominal rigidity, the character of the breathing and hyperalgesia of the skin of the lower thorax are distinctive. In subacute cases the pain is less severe. In chronic cases one finds frequently absence of symptoms. Diaphragmatic adhesions are present and are diagnosed by the roentgen ray.

Subdiaphragmatic abscess most frequently is caused by perforation of a peptic ulcer. Tracking up of an appendicular abscess is another common cause. The condition may be acute or subacute, either on the right or the left side. Gas as well as pus may be present. Roentgen diagnosis is of greatest value when gas is present. An air-containing space separates the arched, raised diaphragm above from the flat-tipped shadow of pus below. In non-gas-containing abscesses roentgen examination is not so helpful, showing only a raised, fixed and immobile diaphragm.—*G. R. Miller.*

Bradley, Wm. N., Zulich, J. Donald, and McKee, Elmer E. Congenital diaphragmatic hernia. *Arch. Pediat.*, June, 1930, *47*, 384–391.

Diaphragmatic hernias are classified as: (1) true hernias, (2) false hernias and (3) eventration. Ninety per cent are of the false type, *i.e.*, without a sac. Embryologically the left side of the diaphragm is more complicated and less likely to close properly. Hence hernias are twelve times as frequent on the left. Usually the esophageal opening is the site of choice. Clinically the condition is rarely diagnosed. Symptoms vary greatly and often are absent. Roentgen diagnosis and autopsy findings suggest that the condition exists about once in 18,000 cases. Any portion of the abdominal contents may herniate. Physical findings of transposition of viscera should suggest the condition.

Most children with this condition live only a few years and the ones who survive are chronically ill with cardiac and gastric symptoms. Strangulation occurs in 15 per cent of cases.

A case is reported in an infant which appeared normal except for slight cyanosis of the palms of the hands and soles of the feet. The apex beat was found to be on the right. Roentgen examination showed the stomach, small intestines and transverse and descending colon in the left side of the chest. Recurrent infections ended in the child's death at the age of nine months from bronchopneumonia. Autopsy showed a large defect in the left dome of the diaphragm. The esophagus passed normally through the diaphragm but curved back through the defect with the stomach. The only sac was peritoneum.—*G. R. Miller.*

ABDOMEN

Gatewood. Subphrenic abscess. *Am. J. M. Sc.*, Sept., 1930, *180*, 398–405.

Forty-one cases of subphrenic abscess during the last ten years gave a mortality of 34 per cent. Of these cases 30 were on the right side, 9 on the left, one multiple and one extraperitoneal (central).

Subphrenic abscesses are either primary (very rare) or secondary by (1) direct extension, (2) lymphogeneous infection, or (3) blood stream infection. Direct extension is from perforations of the stomach, appendix or gall-bladder, or the condition may be part of a generalized peritonitis.

Diagnosis depends upon careful history, the clinical picture and roentgenologic study. Subphrenic abscess should be suspected in postoperative cases not doing well. The onset usually is insidious. Chills, sweats and septic temperature are common. Respiratory symptoms vary with the pulmonary involvement. Cough is not uncommon. Pain in the root of the arch occurs. Physical examination resembles that of consolidation at the base. Leucocytosis varies from 16,000 to 40,000.

The roentgen examination is the most accurate diagnostic measure. The dome of the diaphragm on the affected side is smoothly elevated and splinted. There is a fluid level below the diaphragm in half of the cases. Empyema, liver abscesses, neoplasms and perinephric abscesses must be differentiated.

Treatment is surgical, either by abdominal or thoracic approach, depending on the position of the abscess.—*G. R. Miller.*

Brenizer, Addison G. Deformities and obstructions of the stomach and duodenum. *Ann. Surg.*, Sept., 1930, *92*, 367–375.

The main causes of deformities and obstructions of the stomach and duodenum are: (*a*) ulcer; (*b*) cancer; (*c*) gall-bladder; (*d*) periduodenal membranes and bands; (*e*) diverticula of the duodenum, and (*f*) compression of the duodenum by the superior mesenteric or median colic arteries.

In 84 per cent of ulcer and cancer and in 87 per cent of all the above mentioned conditions there are signs and symptoms demonstrable clinically and roentgenologically. In 90 per cent of cases marked lasting benefit can be derived from proper surgery.

A review of cases provides the statistics and also shows that the best operative results are obtained from resection of ulcer or cancer and proper drainage in obvious obstructive conditions. The principles of enlarging the pyloric orifice (Heineke-Mikulicz), gastrointestinal anastomosis (Woelfer) and gastric resection (Billroth) stand as basic after fifty years of surgery.

The result of treatment depends upon the proper choice of operation, after the most important decision which is whether to operate at all.

All ulcers in the antrum and corpus along the lesser curvature are benign. All ulcers outside this zone are malignant. Obstructive ulcers

along the lesser curvatures showing inflammatory lymph glands may heal without gastrectomy.—*G. R. Miller.*

Miller, Reginald, and Gage, H. Courtney. Gastromegaly and chronic duodenal ileus in children. *Arch. Dis. Childhood*, April, 1930, *5*, 83–132.

The authors report a series of children who exhibited enlargement of the stomach with visible gastric peristalsis or other signs of obstruction high in the alimentary tract. Two of the cases were submitted to operation and were found to be examples of chronic duodenal ileus and it is suggested that owing to the similarity of the other cases to the two operated upon, the origin of the apparent duodenal obstruction was the same in all the cases of the series.

Gastromegaly, or an enlarged and hypertrophied stomach, was the most striking clinical feature of all the cases. Duodenal ileus and arterio-mesenteric occlusion of the duodenum are terms usually given to the condition in which the duodenum is compressed by the root of the mesentery and usually by the superior mesenteric artery, as they lie over the duodenojejunal flexure. Their paper is concerned only with chronic duodenal ileus as it occurs in children. Acute duodenal ileus of the type most commonly seen in adults does not seem to occur in children, there being no mention of it in the literature. Probably the absence of acute cases in children is due to the fact that severe atony and ptosis of the stomach are unlikely to occur in the earlier years of life. Many adult cases which have been operated upon have given histories of attacks of vomiting in early life. In a summary of the literature the authors found that the first type usually found in children was characterized by an obstruction usually so severe as to produce a megaduodenum forming a visible and palpable tumor. The second type consisted of a few cases that simulated the adult type, giving a history of painful dyspepsia of obscure origin, flatulence and attacks of vomiting. The third type, they found, showed ileus associated with other conditions, usually mal-developments and as a fourth type they found one case of duodenal compression from disease of the mesentery and its glands.

In their series apparently every case showed symptoms, etc., due to mild duodenal obstruction. All showed enlargement and hypertrophy of the stomach. The symptoms dated from birth or from early life and consisted at first, more of anorexia than of vomiting. Other symptoms were malnutrition, lack of growth, hiccups and borborygmus, mucus in the feces from the presence of chronic gastritis and occasional fatty stools. A peculiar feature was the comparative lack of pain in the abdomen except immediately preceding vomiting. A tendency to spontaneous improvement seemed to occur in the later years of childhood.

The value of roentgen examination lay, according to the authors, in the fact that it confirmed the presence of obstruction high in the alimentary tract by demonstrating the enlargement of the stomach, suggestive hypertrophy of the gastric musculature and the proved presence of gastric stasis. It also demonstrated satisfactorily in most cases that the site of the obstruction was not at the pylorus or in the stomach. Lack of visualization of the distal parts of the duodenum does not negative the diagnosis of duodenal compression.

To insure satisfactory results from the roentgen examination the opaque meal must not be too small in quantity or too fluid. It must contain food for digestion or the size of the stomach may be masked and the occurrence of gastric stasis missed. Too large a meal may give a false impression of gastromegaly. A standard meal is advised and should be given on an empty stomach after a long period of fasting. Oblique or semi-oblique exposures should be used to overcome the tendency of the enlarged stomach to hide the duodenal cap. The authors also recommend in some cases a primary course of dieting to reduce the size of the stomach sufficiently to expose the duodenal cap in the anteroposterior position. Enlargement of the duodenal cap should be very marked before a diagnosis of obstruction is made as the size of the cap is very variable within physiological limits.

In such cases, intrinsic lesions which must be considered in diagnosis are congenital duodenal atresia or stenosis and cicatrization of peptic ulcer in the newborn. Extrinsic lesions are, obstruction by peritoneal bands, or by arterio-mesenteric bands, obstruction by volvulus, by a diseased mesentery, by malformation or kinking of the duodenum, by tumor or by the pancreas. The prognosis depends on the degree of compression. In conclusion, the medical and the surgical treatment is discussed.—*R. S. Bromer.*

RUBIN, ELI H. Pulmonary and secondary intestinal tuberculosis. *Am. Rev. Tuberc.*, Aug., 1930, *22*, 184–202.

The correlation between pulmonary and intestinal tuberculosis is determined from the case histories and autopsy reports of 500 cases dying of pulmonary tuberculosis at the Montefiore Hospital. In 324 of these cases lesions of intestinal tuberculosis were found. Frequency was as follows: duodenum 1.6 per cent; jejunum 28 per cent; ileum 74 per cent; appendix 22 per cent; cecum 60 per cent; colon 42 per cent; rectum 11 per cent.

Between the ages of thirty-one and fifty there were 65 per cent of cases which showed intestinal involvement. Cases under thirty showed double the incidence of those over fifty. Younger individuals show more extensive involvement. Caseous tuberculosis, more frequent in the young, showed three times as great an incidence of extensive enteritis as did fibroid tuberculosis, commoner in the older patients. Healing ulcers, more frequent in cases with fibrotic pulmonary involvement, were frequently found. Fresh ulcers were often found in the same case. In many respects intestinal and laryngeal tuberculosis followed a similar relationship to the pulmonary type of disease. —*G. R. Miller.*

BALFOUR, DONALD C., and MCINDOE, ARCHIBALD H. Unusual tumors of the gastro-intestinal tract. *Surg. Clin. N. Am.*, Feb., 1930, *10*, 23–31.

CASE I. Benign tumors of the stomach. A man of seventy-two had lost 20 lb. in ten months, had had rumbling in the right lower quadrant, and had dark stools. There was increasing weakness. Total gastric acidity 20, free hydrochloric acid absent. The roentgen diagnosis was polypoid tumor at the pylorus. This was confirmed at operation and the growth removed.

Benign tumors make up 1.3 per cent of all gastric tumors, and occur but once for every 200 malignant tumors and ulcerations. Many histologic types occur.

Pedunculated polyps may prolapse through the pylorus and cause a ball-valve obstruction. Hemorrhage is common. Free hydrochloric acid is absent in uncomplicated cases. Roentgen diagnosis is only suggestive, usually being based upon a circumscribed and punched-out filling defect on the gastric walls.

Small adenomatous polyps show a potentiality for malignancy.

CASE II. Secondary anemia in malignancy of the small intestine. A man of fifty-three had had nocturnal epigastric pain for six years. During this time he had three severe gastrointestinal hemorrhages. The picture on admission was that of secondary anemia. Roentgenograms were negative. There was melena and achlorhydria. Operation disclosed a cellular carcinoma of the jejunum with metastasis.

This is an interesting cause of secondary anemia. The case suggests exploratory operation in cases of unexplained gastrointestinal hemorrhages. An interesting feature is the duration of six years with hemorrhages four, three, and two years before the present admission.

CASE III. Pellagra after jejunostomy. A woman of forty-six with a history of two attacks of severe gastrointestinal hemorrhage showed a large fundal lesion by roentgen examination. This appeared to be malignant at operation but moderately high acid figures and absence of demonstrable metastasis suggested benignity. Jejunostomy was performed, a No. 20 catheter being used. Due to the small catheter, feeding was inadequate and pellagra developed. This cleared up with proper nutrition. Later the fundal lesion decreased markedly and therefore was considered definitely benign.—*G. R. Miller.*

BARGEN, J. ARNOLD, and JACOBS, MINARD F. Inflammatory cecal tumors; diagnosis of types of obscure etiology. *Arch. Surg.*, May, 1930, *20*, 832–850.

The authors report a series of cases of inflammatory tumors of the cecum because of their relative rareness, the diagnostic difficulties and therapeutic problems afforded by such tumors.

Before presenting the cases a brief review of some of the less common cecal tumefactions is given. Among these are lymphosarcoma, actinomycosis, cholesteatoma, lipoma, leiomyoma, mucous cyst, and hemorrhagic infarction.

In addition to the inflammatory tumors two additional groups of tumors offering some difficulty in differentiation are reported. The cases are divided into three groups:

Group 1. Inflammatory lesions of the ileocecal coil causing palpable tumor or roentgenologic deformity or both.

Group 2. Definite pathologic conditions that

are difficult to differentiate from those of Group 1.

Group 3. Marked obstipation in which so-called pelvic cecum caused difficulties in the differential diagnosis.

In the way of comment the authors state that in the differential diagnosis of tumors of the ileocecal region, malignant disease must be given first consideration. Helpful in the recognition of the inflammatory tumors is the fact that in these cases presenting a palpable mass and positive roentgenologic data, the appearance of the patient is not that usually presented by malignancy. Also the history offers the most important clue. The usual absence of anemia and the patient's general sense of well-being are important in the diagnosis. Finally the filling defect typical of a malignant condition is rarely found in an inflammatory tumor of the cecum.—*Karl Kornblum.*

GENITOURINARY SYSTEM

Jacobs, Arthur. Horseshoe kidney. *Brit. M. J.*, July 5, 1930, *2*, 8.

Horseshoe kidney is one of the most frequent renal anomalies. Either the upper or the lower poles of both kidneys fuse. The latter is more common. Renal parenchyma in the fused part which lies anterior to the great vessels varies in amount. The ureters, usually two in number, arise from separate pelves and pass anterior to the isthmus, but because of their unusual position and curvature these kidneys are predisposed to obstruction, infection and stone.

Two cases are reported. In the first albuminuria led to a roentgenographic examination showing calculus. Bilateral pyelography showed the uteropelvic junctions to be lateral. The isthmus was divided at operation but a urinary fistula persisted due to having cut across a calyx in the resected portion of the isthmus. In the second case a laborer with backache and hematuria showed hydronephrosis on the left with calyces directed medially. The right was normal. No operation was performed.

Surgery in cases of horseshoe kidney is materially assisted by a previous knowledge of the existence of the condition. Bilateral pyelographic study is the best means of diagnosis. The abnormalities are due to failure of rotation of the renal pelvis. The axis of the calyces is median or anterior and the ureter leaves laterally or anteriorly.—*G. R. Miller.*

Moots, Charles W., and Magoun, James A. H. The importance of urography in the interpretation of abdominal symptoms. *Am. J. Surg.*, April, 1930, *8*, 866–871.

This paper deals with the necessity of a urological study in patients presenting abdominal symptoms. A list of the common conditions from which urinary tract pathology must be differentiated is given. The paper is concluded with a report of 10 cases in which urography was of aid in establishing the diagnosis.—*Karl Kornblum.*

Cooke, Robert V. On excretion urography. *Lancet*, Sept. 27, 1930, *2*, 686–688.

This is a report based on experience with excretion urography gained in 36 cases. The method of administration consisted in the intravenous injection of 40 to 60 grams of uroselectan freshly dissolved in 100 to 150 c.c. of water. The larger doses gave no better results. The solution is injected slowly (10–15 minutes). Leakage into the subcutaneous tissue is to be avoided as painful induration followed this accident in two cases. The time of taking the roentgenograms was fifteen minutes, forty-five minutes and one hour and fifteen minutes.

No toxic effects were noted. In one case of polycystic disease in which the blood urea was 160 mg. per 100 c.c. a dose of 60 gm. produced no untoward effect whatever. The kidney function must be very bad before the test becomes dangerous.

Some points emphasized by the author are the necessity of thoroughly cleaning out the intestinal tract before the examination, and the value of the method in the diagnosis of abdominal swellings of uncertain nature. Two cases are cited; in the first a uroselectan study revealed an infected ectopic kidney which had previously been diagnosed an appendicial abscess; in the second case it was possible by uroselectan to show the complete outline of a horseshoe kidney, proving that the two kidneys were united by actively functioning renal tissue instead of fibrous bands as is often the case. This information had not been obtained from a previous retrograde pyelogram.

The method permits pyelographic study of cases from the out-patient department and thus eliminates hospitalization and the saving of hospital beds. In addition the procedure affords an easy method for following the course of urologic diseases and the results obtained by

treatment. In cases of infection it eliminates the danger of spreading the infection which may occur during instrumentation. In cases where it is not possible to study renal function because of complete obstruction to the ureter, as sometimes occurs in ureteral stones, uroselectan will often reveal an organ which is functioning satisfactorily. In such a case simple removal of the obstruction rather than a nephrectomy is indicated. In this connection the author states that it is important to bear in mind that the functional activity of a kidney can be temporarily inhibited, and the nonvisualization at a particular examination does not necessarily mean a permanently damaged kidney.

The method has its limitations since it depends upon renal function. Where function is destroyed or impaired satisfactory roentgenograms are often not obtained. The procedure does not supplant retrograde urography. Since in so many cases cystoscopy is absolutely essential it is still quicker (and cheaper) to proceed to ureteric catheterization and retrograde pyelography in the average case.—*Karl Kornblum.*

Willan, R. J. Radiography during operation for renal calculus. *Brit. M. J.*, Oct. 4, 1930, *2*, 552–553.

The author describes the method used by him of roentgenography during operation for renal calculus. The apparatus employed is an ordinary Dean 16 inch coil set which is always in the operating room and can be mounted, ready for use in three minutes. The film, in its paper covering, is wrapped in a dry sterile cotton cylinder. The exposed kidney is made to lie upon the film. In the case of a short pedicle, the film is pushed down into the wound. An exposure time of one second usually suffices. A dry operative field is emphasized to prevent damage to the film and to guard against sepsis. A technician stands by and develops the film, which has usually been available in three to five minutes. The author prefers the taking of films rather than roentgenoscopic examination of the kidney, because of the technical difficulties and unreliability of the latter method. After the removal of a calculus another film is made to be certain that no fragments have been left behind, and in the case of multiple calculi, to make certain that all have been removed.

Four illustrative cases are given: (1) of a previously known renal calculus; (2) of an occasion when a uric acid stone was suspected but whose presence could not be proved prior to roentgenography of the exposed kidney; (3) of a man in whom, after supposed removal of all the calculi, a remaining one was detected by roentgenography and removed; (4) of a sequel to a nephrolithotomy performed eight years before, the result being a functionless kidney owing to the extensive trauma at that operation.

The claims made for the use of this procedure are: (1) guarding against the recurrence of stone, and (2) detection of the exact site of a renal calculus and thus preventing the needless sacrifice of renal tissue when the calculus must be searched for.—*Karl Kornblum.*

SKELETAL SYSTEM

Boorstein, Samuel W. Cleft hand. *J. Bone & Joint Surg.*, Jan., 1930, *12*, 172–176.

Cleft hand (lobster claw hand) is a rare deformity. Boorstein reports such a case. The roentgenograms showed a normal radius and ulna in the right hand and forearm. The thumb had a metacarpal and two phalanges, but the terminal phalanx was much smaller than normal. The index finger showed a metacarpal and three phalanges; the rudimentary finger which was present had a metacarpal and three phalanges, but all of these were much smaller than those of the index finger.

The left hand had a radius which was curved to the radial side and was shorter than the right. There was also a little round piece of bone near the upper end of the radius, which was the only part of the ulna present. The thumb and index finger seemed to have the normal number of phalanges, but these were somewhat smaller than normal. Illustrative roentgenograms are reproduced.

Boorstein discusses the classification of congenital deformities of the hand and also the various theories of causation of these deformities. He groups this deformity under the general group of Steindler's classification, deformities by developmental suppression, agenesis. In this group the subdivisions are: (1) congenital defect of the forearm bones (congenital club hand), (2) cleft hand (lobster claw hand, (3) ectrodactylia (aphalangism).—*R. S. Bromer.*

Burman, M. S., and Lapidus, Paul W. Unusual appearance of the accessory scaphoid and the styloid epiphysis of the fifth metatarsal. *J. Bone & Joint Surg.*, Jan., 1930, *12*, 160–164.

A case is reported in which the first series of roentgenograms showed the bilateral presence of the accessory scaphoid and of the styloid epiphysis of the fifth metatarsal. The bone outlines were clear, but the bones were larger than usual. Both of the accessory scaphoids and the styloid epiphyses had a patchy appearance, interpreted as an epiphysitis. The second set of roentgenograms, taken about nine months later, showed the complete restitution of the accessory scaphoids, but the styloid epiphyses still showed some enlargement and patchy density.

The authors state that the accessory scaphoid exists as a preformed cartilage at the second month of fetal life. It is not manifested roentgenologically until the age of nine, more usually eleven, according to Sever. From their own observations they believe that the accessory scaphoids are usually well outlined and of homogeneous density at all ages. It often fuses with the scaphoid but may have an epiphyseal center of its own. There may be multiple centers of ossification. They do not believe that the accessory scaphoid is an epiphysis of the scaphoid. The styloid epiphysis has been the subject of some controversy as to whether or not it is the vesalian bone.

Despite the absence of tenderness they feel that this case is an epiphysitis, the age of the patient, the similarity of the roentgen appearance to that of other epiphysites, and the complete restitution of the accessory scaphoid, all favoring that diagnosis. As in all epiphysites one may speculate on the etiology of the condition, whether traumatic, infectious, circulatory, etc. It is possible that the disease would be found to be more common if roentgenograms were made at the opportune time. This case having probably been a "silent" epiphysitis in which the prognosis is good, it seems likely that many cases are overlooked because roentgen examinations are not made due to the lack of symptoms.—*R. S. Bromer.*

Van Wagenen, W. P. Spina bifida. *Arch. Pediat.*, July, 1930, *47*, 436–441.

The author reports two cases of spina bifida where the sac presented in an unusual location, one over the sacroiliac joint, and the other to the lateral side of the spine at the thoracolumbar junction. These cases demonstrate that a spina bifida sac must be added to the list of possibilities considered in a differential diagnosis of tumors of the back lateral to the midline of the spine. This is especially indicated where roentgenograms show congenital deformities of the vertebrae.

The third case illustrated the rare occurrence of bone and cartilage in the true wall of a meningocele sac, diagnosed pathologically as a teratoma.—*F. K. Alexander.*

Zweible, Leonard. Studies in the embryology of bone development. *Am. J. Surg.*, March, 1930, *8*, 517–525.

A method is described for the preparation of embryos whereby the bones may be seen in situ for the purpose of studying their development. The method of preparation of the specimens consists of two distinct processes, the first being the depigmentizing of the soft tissues and the other, the staining of the bone tissue. In the completed specimen, the entire bony skeleton is visible, as well as the cartilage that has some calcium in it. The bones take a definite red opaque color and the cartilage a brownish translucent hyaline-like appearance. The process, however, is a time-consuming one. The smallest embryo, of ten to twelve weeks, requires about three months, while a full-term fetus requires approximately two years for completion.

It is believed that specimens prepared in this manner offer a distinct advantage over the use of roentgenograms for the study of bone development. It is claimed that the changes are much more clearly shown and can be much earlier detected. In addition the specimens afford a means of studying the bones in the third dimension.

A sketchy description is given of the development of intramembranous and intracartilaginous bone. Brief reference is made to conditions in which abnormal bone development is found such as congenital lues, congenital rickets, placental infarcts, oligohydramnios, chondrodystrophia fetalis and osteogenesis imperfecta.—*Karl Kornblum.*

Roy, Hartzell H. Diaphyseal aclasis; hereditary deforming achondrodysplasia. *Arch. Pediat.*, March, 1930, *47*, 152–164.

Multiple cartilaginous exostosis is one of the

more uncommon, but not rare deforming bone affections. The disease is twice as common in males as in females and the onset is usually recorded in the first year although it has been observed as late as twenty years. Of the cases reported in the literature in which heredity was noted, 79 per cent had a positive history.

The etiology for this disorder is obscure. The findings of a hereditary origin are impressive, though in many instances the appearance of the condition at birth makes it seem probable that the affection is congenital. Because of the bone deformities many have classed diaphyseal aclasia with rickets and suggest vitamin deficiencies. Tuberculosis, trophic bone disorders of the metaphysis, and disturbance in the organs of internal secretion which influence bone growth have been suggested.

The pathological aspects of the disease have been well observed, the common findings in the many reports being: (1) only the bones of intracartilaginous origin are affected; (2) there is a disturbance in the proliferation and calcification at the metaphysis of the long bones; (3) isolated inclusions of cartilage are found both within and beneath the periosteum, and (4) there appears to be a deficiency in the "modeling process" most marked near the end of the diaphysis. The cartilage cells proliferate in irregular groupings and this excessive and irregular growth gives rise to abnormal outgrowth of bone, which occasionally contains marrow cavities.

Many variations in the clinical picture are found from a few small exostoses which result in no disturbance of function and give rise to no symptoms, to multiple exostoses, great deformities, dwarfing, blood vessel, nerve and central nervous system complications.

The author reports a case in which most of the bony skeleton gave roentgen evidence of irregular bony projections with occasional areas of increased transparency.—*F. K. Alexander.*

Shands, A. R., Jr. Neuropathies of the bones and joints. *Arch. Surg.*, April, 1930, *20*, 614–636.

The following classification of the neuropathies of bones and joints, based on etiologic factors, is presented.

1. Tabes dorsalis
2. Syringomyelia
3. Following lesions of the peripheral nerves
   (*a*) Injury
   (*b*) Peripheral neuritis
   (*c*) Leprosy
4. Following lesions of the spinal cord
   (*a*) Injury
   (*b*) Congenital malformations
   (*c*) Tumors
   (*d*) Tuberculosis of the spine
   (*e*) Acute myelitis
   (*f*) Anterior poliomyelitis
   (*g*) Progressive (central) muscular atrophy
      (1) Aran-Duchenne type
      (2) Spastic type (amyotrophic lateral sclerosis)
5. Following lesions of the cerebrum
   (*a*) Dementia paralytica
   (*b*) Hemiplegia following cerebral hemorrhage.

Tabes dorsalis and syringomyelia are so common as compared with the other groups that they were given separate headings.

Charcot was the first to describe the arthropathies associated with tabes dorsalis. His cases showed firm, painless swelling of a joint, not apparently, caused by trauma. Rapid changes occurred in the joint surfaces giving rise to luxations and false positions of the bones. Joints presenting these characteristics are frequently referred to as Charcot's joints whether they are associated with tabes or not.

A long and detailed reference to cases from the literature is given. The changes in the bones and joints reported by various authors are numerous and varied and by no means constant. Observations at times have been contradictory.

Some of the outstanding features from the literature are the facts that in tabes, joint symptoms occur in from 3 to 4 per cent of the patients, while in syringomyelia they are present in from 10 to 40 per cent. Of the tabetic arthropathies, the lower extremities are affected in 75 per cent of the patients, while in those due to syringomyelia, the upper extremities are affected in 80 per cent of cases. In tabes the lumbar spine, while in syringomyelia the cervicodorsal spine is most often affected. The cause of the changes in the bones and joints seen in the neuropathies is not the division of the sensory nerves but a partial division resulting in prolonged irritation. This has been shown to be the case in the experimental production of neuropathic joints.

The roentgen changes to be observed are atrophy of the bone ends, osteoporosis with erosion, osteosclerosis, proliferation of irregularly shaped bone masses and osteophytes and

osteoplastic periostitis along the shaft of the involved bones. In addition, there is marked enlargement of the joint with various forms of luxation.

A case report which forms the basis of this paper is given in much detail. The neuropathy involved the left ankle which followed an injury to the leg. A careful study of the foot, ankle and lower leg after amputation showed many of the changes reported in the literature. The etiologic factor in this case appeared to be a peripheral nerve lesion, as the posterior tibial nerve was found to terminate in scar tissue above the joint.—*Karl Kornblum.*

Jones, R. Watson. Primary nerve lesions in injuries of the elbow and wrist. *J. Bone & Joint Surg.*, Jan., 1930, *12*, 121–140.

This investigation is based on a series of 5000 fractures and dislocations in the elbow and wrist lesions. Most of the cases were observed at the Liverpool Royal Infirmary.

In this series there were 97 cases of elbow dislocation. Thirty-two of these were backward dislocations and of these, two were complicated by a musculospiral paralysis. In these cases recovery followed simple conservative treatment after reduction of the displacement. In one of the 29 cases of dislocation backwards and outwards, there had been traction on the median nerve over the lower end of the humerus with an incomplete palsy which recovered rapidly. In 16 cases of pure outward dislocation with no trace of backward displacement, there were no less than 12 with ulnar palsy, and these were the only cases of ulnar palsy in the series.

In about 25 per cent of elbow dislocations there is an associated injury to the internal epicondyle, and in children it is the epiphysis of the epicondyle which is torn off by the aponeurotic common flexor origin. Usually because of its attachment to the forearm bones, this epiphysis is replaced accurately in position when reduction of the forearm bones occurs. There is one exception to this, when in pure outward dislocation the epiphysis can very easily become imprisoned in the inner half of the elbow joint during reduction; it may also be imprisoned in the joint when there is no associated outward dislocation. In both instances there is a valgus strain, and the condition is invariably associated with ulnar palsy. Jones does not believe that the ulnar palsy in these cases is produced by contusion of the nerve by direct injury as suggested by Platt. Epicondylar injuries may be divided into two groups: (1) the group due to direct trauma, which may vary from a simple crack to an extensively comminuted fracture, but in which, contrary to expectation, the nerve is rarely damaged; (2) the group which comprises four divisions depending upon the degree of trauma; (*a*) the mild strain producing slight separation of the epiphysis and no nerve injury, (*b*) the more severe strain, with displacement of the epiphysis down to the level of the joint and occasionally traction nerve injury; (*c*) the actual springing open of the joint, so that the fragment slips in and nerve palsy is practically always present, and (*d*) the continuance of the force sufficiently to dislocate the joint completely and inevitably to produce a nerve injury unless there is associated backward displacement. When the epicondyle lies within the joint, operation is necessary.

In supracondylar fractures of the humerus, Jones states that it is well recognized that injudicious treatment may readily produce a secondary friction neuritis of the ulnar nerve. Primary ulnar palsy, on the other hand, is rarely found. But in a type of displacement—marked outward and forward displacement of the distal fragment and the forearm—the trunk of the nerve is stretched and primary ulnar paralysis results. This is the only lesion in the group of supracondylar fractures which showed primary ulnar palsy.

Primary ulnar palsy in elbow injuries has the same pathogenesis as delayed ulnar palsy, in that it is produced by traction in cubitus valgus deformity. Primary musculospiral and median palsies in elbow injuries are due to traction in backward displacements. They are not serious in backward dislocations where traction occurs over a smooth rounded surface of the humerus, but in supracondylar fractures, exploration is frequently necessary because of the traction which is exerted over a jagged fragmented surface of the humerus, thus producing more serious nerve injury.

In fracture dislocations of the wrist and in cases of dislocation of the carpal semilunar bone, primary ulnar palsy rarely arises by traction, because the nerve has free mobility, but sometimes it complicates severe displacements of the lower radial epiphysis when the injury is due to contusion by the radial diaphysis.

Primary median palsy in wrist injuries is

rarely due to fractures of the lower end of the radius, because the nerve is protected by the pronator quadratus, but is frequently due to forward dislocation of the carpal semilunar bone.—*R. S. Bromer.*

Pearse, H. E., Jr., and Morton, J. J. The stimulation of bone growth by venous stasis. *J. Bone & Joint Surg.*, Jan., 1930, *12*, 97–111.

The authors review the literature of treatment of fractures with delayed union by venous stasis hyperemia. They report their experiments upon animals. Twelve dogs were operated upon. In one animal non-union of the fibula in each leg resulted, apparently because a thin, fragmented periosteum allowed muscle to come between the fragments. In every other instance, union was accelerated on the side having the vein ligated, according to their technique, which is fully described.

They have treated 5 cases of delayed union by venous stasis, and report 2 of these in full. In summing up their observations, they believe that their cases confirm the reports in the literature which show that fractures with delayed union may be healed by venous stasis hyperemia. Their recorded experiments demonstrate accelerated union of bone in the presence of venous stasis.—*R. S. Bromer.*

Groves, E. W. H. Treatment of fractured neck of the femur with especial regard to the results. *J. Bone & Joint Surg.*, Jan., 1930, *12*, 1–11.

Groves states there are three common errors of practice or teaching in regard to treatment of fractures of the neck of the femur: (1) the treatment of such fractures by expectant methods without making an exact diagnosis by the roentgen ray; and, closely allied to this, is the too ready interpretation of a single roentgenogram as indicating an impacted fracture which requires no special treatment; (2) the error of considering an old patient with a fractured neck of the femur as unsuited for any active treatment; (3) the idea that non-union of the fracture is the result of old age and that a young adult will therefore recover when treated by simple traction.

He advances four propositions as generally accepted in the treatment of this condition:

1. The diagnosis of all cases of hip injury requires a careful roentgen study. It is extremely difficult to be certain of the existence or degree of impaction. It is a grave and unjustifiable risk to allow early movement or weight-bearing in a case where impaction is suspected.

2. Every patient with a fractured femoral neck should receive treatment adequate to secure the best chance of union in correct position. There is no need to institute this treatment for a week or ten days after the accident, and this period gives ample time for the recovery from shock. The fixation of the hip in a patient of seventy or eighty years never can, never did, and never will cause death from "hypostatic pneumonia."

3. Fractures of the transcervical or intracapsular variety are of quite common occurrrence in young or middle-aged patients. Such fractures will never unite unless natural or artificially induced impaction is brought about.

4. Fractures of the basal or extracapsular variety are liable to impaction, accompanied by comminution and great distortion. Such a condition urgently demands disimpaction at the earliest possible moment. These fractures have a great tendency to malunion, but they always unite quickly and strongly after such procedure.

Groves gives the statistical results of his own series of cases and also of a combined series of cases (other authors). From the combined series two rather depressing facts stand out: the first, that nearly one-quarter fail to obtain bony union; and second, that rather more than one-half, 53 per cent, present results which can only be described as "fair," "poor," or "bad."

He feels he cannot prove which method in the basal type, Whitman or traction, is the better because he has not had sufficient cases on which to base a comparison. In the extracapsular or basal, operation is never considered.

He regards only two methods of treatment worth consideration in the true intracapsular or transcervical fractures, the Whitman, and the pegging operation. He recounts his experience with each.

In discussing the secondary treatment of ununited fractures he reports 4 out of 5 of his cases which showed good bony union even though the age was as much as sixty-eight years or the period since fracture was as much as twenty-three months. He regards it as a mistake to apply the pegging operation to all ununited fractures of the neck of the femur. In some cases it is much wiser to remove the head of the bone and do a reconstruction operation.

Blind pegging often leads to faulty fixation. He is satisfied that the beef bone or ivory peg is greatly superior to that cut from the human tibia, and of course there is the advantage that the former shortens and simplifies the operation.—*R. S. Bromer.*

Herendeen, Ralph E., and Lewis, Raymond W. Lesions of the greater trochanter. *J. Bone & Joint Surg.*, Jan., 1930, *12*, 15–22.

The authors direct attention to the wide variety of lesions which occur in the region of the greater trochanter. The variety is much greater than mere casual consideration might suggest. They show only one case of each type of disease with illustrative roentgenograms. The list of cases follows:

1. Pretrochanteric bursitis (probable diagnosis).
2. Pretrochanteric bursitis with osteitis of underlying greater trochanter (probable diagnosis).
3. *Staphylococcus aureus* osteitis of greater trochanter (diagnosis established).
4. Typhoid osteitis of greater trochanter (probable diagnosis).
5. Tuberculosis of greater trochanter and pretrochanteric bursa (diagnosis established).
6. Brodie's abscess or cyst of greater trochanter (probable diagnosis).
7. Chondroma of greater trochanter (diagnosis established).
8. Osteitis fibrosa cystica or giant cell tumor of greater trochanter (probable diagnosis).
9. Giant cell tumor or plasma-cell myeloma of greater trochanter (probable diagnosis).
10. Endothelial myeloma of greater trochanter (probable diagnosis).
11. Osteogenic sarcoma or endothelial myeloma of greater trochanter (probable diagnosis).—*R. S. Bromer.*

Brunschwig, Alexander. Solitary bone cysts of long duration. *J. Bone & Joint Surg.*, Jan., 1930, *12*, 141–149.

A case of solitary bone cyst of the humerus of thirty-eight years' standing is reported. It had a fibrous lining which was extensively calcified in almost its entire extent and which cast a shadow in the roentgenogram. The presence of such extensive calcification is a very unusual finding in the cases of long-standing bone cysts which have been reported. In view of the small number of such cysts reported, however, it is impossible to state whether or not much calcareous deposition is characteristic of very old cysts. The fluid within the cyst was loaded with cholesterol crystals, also an unusual finding. In the bone surrounding the cyst lining there was no fibrosis of the marrow; only fatty marrow was present. In the same patient several joints exhibited arthritis deformans, raising the question of a possible bacteriological relationship between the two conditions. Cultures of the cyst lining and of the synovia of the left elbow joint in the above cases were reported negative. The age of the cyst and the small amount of synovia may possibly have accounted for this. Brunschwig states that the histological appearance of the lining and contents of recent bone cysts is similar in many respects to the appearance of the lining and contents of smaller cavities found in the ends of bones involved in joints affected by arthritis deformans. He considers that the negative bacteriologic findings in this case militate little against the infectious theory for the etiology of these lesions. The treatment of bone cysts of long duration is essentially the same as for recent cases, although operation may not be indicated because of the fact that the lesion becomes quiescent or heals spontaneously. In his case the lesion was quiescent and the only therapeutic benefit derived from the operation was regenerative strengthening of the bone against possibility of pathological fracture.—*R. S. Bromer.*

BLOOD AND LYMPH SYSTEM

Reuben, Mark S., and Douglas, Harry. Mikulicz's syndrome in leukemia. *Arch. Pediat.*, July, 1930, *47*, 442–451.

Mikulicz's disease is usually considered as a more or less chronic enlargement of the lacrymal and salivary glands. The author reviews the literature and reveals the fact that this syndrome is not a disease entity but a group of symptoms which can be found in the course of many diseases, such as leucemia, tuberculosis, syphilis, sarcoma, and others. In each case the pathological findings are those of the underlying disease.

The syndrome without leucemia is most frequently reported in adults. No age is exempt, and males are more often affected. There is first a gradual enlargement of the lacrymal glands resulting in a ptosis and exophthalmos with mechanical interference of vision. Lacry-

mation is an early symptom, and sooner or later there is involvement of the parotid and submaxillary and sublingual glands. The tumors are firm, smooth, painless, free from tenderness and not adherent. Neither the neighboring nor the distant lymphatic glands are involved. The spleen and the liver are not enlarged. There is no fever and no malaise. The function of the glands may or may not be deranged. Preëxisting and co-existing conjunctivitis has been noted. The condition may last for years, may respond to treatment—roentgen rays, radium, surgery, or spontaneous cure. There is little tendency to shorten life and death is due to intercurrent disease.

The author reports a case of lymphatic leucemia in a boy five and a half years of age in whom Mikulicz's syndrome was very well developed.—*F. K. Alexander.*

GENERAL

Dickey, Lloyd B. The etiology of erythema nodosum in children; its relation to early tuberculous infection. *Am. J. M. Sc.*, Oct., 1930, *180*, 489–497.

Since Pons observed giant cell formation in the center of a nodule of erythema nodosum and Landanzy an acid fast bacillus in the lumen of a vessel within a nodule, the belief has been kept alive that true erythema nodosum is always related in some way to tuberculosis. Evidence has been accumulated in the literature which proves that erythema nodosum may be caused by or associated with other conditions than tuberculosis. It has been reported as associated with smallpox, influenza and other infectious diseases. Most children who have erythema nodosum exhibit marked hypersensitiveness to tuberculin given intracutaneously. Ernburg called attention to the similarity of the nodule to an artificially elicited tuberculin reaction in a tuberculous individual. Occasionally the lesions resemble each other clinically and the two are very similar histologically.

The author reports 9 cases of erythema nodosum all of which had positive tuberculin reactions. In one case the erythema nodosum followed the tuberculin test. He concludes that the lesion may occur in non-tuberculous individuals or in those infected with the bacillus though the great majority of cases of erythema nodosum in children is associated with an initial or recent infection.—*F. K. Alexander.*

ROENTGEN AND RADIUM THERAPY

Altschul, Walter. Seltene Indikationen der Röntgentherapie. (Unusual indications for roentgen therapy.) *Strahlentherapie*, 1930, *36*, 183–187.

Three cases are reported in which roentgen irradiation gave surprisingly good results. They are only single cases so no conclusions can be drawn but they suggest interesting possibilities.

The first was a case of ankylopoietic spondylarthritis in a man of thirty. In 1919 he had pain which was diagnosed as sciatica and cured by treatment at a watering place. But it recurred a year later and as it grew worse in spite of similar treatments he was sent to the author for roentgen treatment. Examination showed an ankylotic spondylarthritis of the cervical and lumbar parts of the spinal column. This disease generally extends to the whole spinal column and leads to complete ankylosis. The patient was irradiated with small doses. Four and later 5 fields along the spinal column were irradiated; the dose on each field was a third of an erythema dose under 4 mm. aluminum. Treatments were given on March 5, April 19 and June 21. After the first treatment there was decreased pain and greater mobility. The patient came back after four months and the improvement had made further progress; he was able to work. Three further treatments were given on Nov. 1, Dec. 13 and Feb. 14. In 1928 an inflammation of the hip-joint developed which led to ankylosis of the hip. The patient had stopped roentgen treatment and was growing worse under treatment at Joachimsthal.

The second case was one of humeroscapular periarthritis in a man of forty who for two days had very intense pain in his right shoulder joint. The slightest movement of the arm caused intense pain. A tangential picture showed calcifications beside the head of the humerus, probably in the subdeltoid bursa. The picture was that of a humeroscapular periarthritis, though it was at an atypical place. Roentgen irradiation was given for the pain without any hope of really affecting the process. There was quite an intense reaction at first with increase of pain and fever. Four days later improvement began and progressed rapidly. Eight days after the irradiation a roentgen picture showed that the calcium shadow had completely disappeared. Two treatments were given on two successive

days, the first one of about 100 R and the second of about 50 R.

The third case was one of hemorrhagic diathesis in a man forty-nine years of age who entered the hospital for copious hemorrhage of the bladder. A roentgen picture showed an irregular defect with jagged edges at the vertex of the bladder; the picture was typically that of carcinoma of the bladder. The infiltration around the bladder and thighs which had at first suggested urine infiltration proved to be a large hematoma. The patient said that he had frequently had such infiltrations of the upper arms and thighs. Because of the hemophilia calcium Sandoz was given and the spleen irradiated twice. Assuming that there was a carcinoma of the bladder, the bladder was irradiated over 3 fields with a skin erythema dose to each followed four weeks later by half an erythema dose. The patient recovered completely and was discharged free of symptoms. He did not come back so it was impossible to make an accurate diagnosis. A bladder carcinoma could not have been cured so quickly and completely so it is probable that the tumor was a hematoma. But it was a striking fact that the hemophilia which he had for years should have improved so greatly.—*Audrey G. Morgan.*

QUIMBY, EDITH H., and PACK, GEORGE T. The skin erythema for combinations of gamma and roentgen rays. *Radiology*, 1929, *13*, 306–312.

Recently some clinical evidence has been brought forward to show that when treatment is given by means of a combination of gamma and roentgen rays, the skin reaction is less marked than when only one type of radiation is used. In this investigation the authors studied the effect of combining gamma rays and roentgen rays of essentially the type used in deep therapy. The gamma rays were obtained from two platinum tubes containing 50 mg. of radium each. These were 0.5 mm. in wall thickness, 20 mm. long, 4 mm. in diameter, and were held side by side at a distance of 1 cm. from the skin in a container made of balsa wood and hard rubber. This container acted as a filter for secondary rays from the platinum. The roentgen rays were generated by a constant potential machine (kenotrons and condensers) operated at 165 kv. (measured spectrographically) and 3 ma., with a filter of 0.4 mm. of copper and 1 mm. of aluminum, a target-skin distance of 50 cm., and an area 3 by 3 cm. on the skin. The threshold erythema dose for each of these types of radiation was determined first in the usual way.

For the effect of combined doses the procedure was as follows: The radium container was strapped to the patient's right leg, just above the knee (this being the area used in all the tests), and from 40 to 70 per cent of an erythema dose given. The area treated was outlined with ink and the patient taken immediately to the roentgen-ray department, where he was given the corresponding dose of roentgen rays over the same area. A different dose of roentgen rays was given to the corresponding area of the other leg, and the patient returned to the ward for the proper dose of gamma rays to the second area. Thus two complete series of tests were made, in one of which the radium was applied first, in the other the roentgen rays. In very few cases did more than fifteen minutes elapse between the successive irradiations to the same area, and usually the interval was less.

In all, 100 tests were given with combined radiations, but complete observations were possible in only 79. In each case the dose administered was half gamma and half roentgen rays. There is no conclusive evidence that it made a difference which was used first. A curve plotted for the total percentages of positive reactions is shown in a table. From the curves it is evident that it takes a combined dose of 133 per cent to produce the threshold erythema, that is, 80 per cent positive results. It is also evident from the curves and tables that, for these two radiations administered as stated above, it takes a larger amount of the two in combination than of either one alone to produce an erythema, but this does not justify the conclusion that, as the rays are employed in therapy, a larger amount can be administered if a combination is used. It does, however, lend support to the clinical evidence pointing in the same direction. It has no bearing whatever on the therapeutic efficacy of combining different types of radiation.—*J. D. Camp.*

PERUSSIA, FELICE. Efficacia della radiumterapia in carcinomi cutanei estesi, inveterati, recidivanti. (Efficacy of radium treatment in extensive, stubborn and recurrent skin carcinomas.) *Radiol. med.*, Apr., 1930, *17*, 397–403.

Six particularly severe cases of skin carcinoma treated with radium are described. The first was in a man of forty who for eighteen years had a form of skin epithelioma which had gradually extended to all the right side of his head and part of his face, leaving large necrotic areas on the parietal, frontal and temporal bones; the superficial ulcers bled easily and frequently. His general condition was serious; he had already had various operations, treatment with carbon dioxide snow and with roentgen radiation, all with only partial and temporary results. Radium treatment was given by means of 16 needles inserted along the margins of the ulcers, each containing a milligram of radium element with filtration through half a millimeter of platinum. They were left in place for eight days, giving a dose of 25 mc. When the needles were removed a large cap was made of Columbia paste containing 115 mg. radium element distributed over 14 foci with a focal distance of 3.5 cm. and a filtration of a millimeter of platinum. The apparatus was left in place for twelve days, giving a total dose of 41 Dominici units. There was slow but progressive improvement and photographs are given showing the enormous change from June 30, 1929, the date when the treatment was finished up to February, 1930, and there has been still further improvement since then.

Case 2 was a similar one in a woman of seventy-two who had an enormous epithelioma covering the left half of her face with areas of necrotic exposed bone in the mastoid, auricular, temporal, parietal and frontal regions. The disease had begun five years before and the patient had been treated with roentgen rays and radium with only transitory results. She was weakened by repeated hemorrhage. In this case too the treatment was by needles (17 mc. in 8 days with a filter of 0.5 mm. platinum) followed by a surface apparatus for eight more days, giving 40 Dominici units. The course was similar to that in the preceding case.

The third case was particularly serious because of the infiltrating character of the enormous carcinoma of the eye with proliferation into the nasal fossae in a woman of seventy. She had the tumor for three years. Vegetations of the cheek had been destroyed by diathermia. A Columbia paste mask was applied which contained 76 mg. radium distributed over 9 foci with filtration varying from 1 to 2 mm. platinum and with a focal distance varying from 1 to 3 cm., depending on the depth of the infiltration; 42 Dominici units were given in six days. There was rapid and progressive improvement and three needles were inserted in the nasal tumor, giving a dose of 9 mm. in five days. In two months and a half the tumor had entirely disappeared and there was only a slight ulcer of the right ala nasi. Unfortunately the patient died soon afterward of bronchopneumonia. Histological examination of tissue from the edge of the ulcer only showed a few cancer nests undergoing marked degeneration.

The fourth case was in a man of thirty who had an epithelioma of the nape of the neck for seven years. All treatment had proved ineffective, including roentgen therapy. The technique was similar to that in the other cases. There was local recovery but the patient died of metastases at the base of the brain and in the lung.

The fifth case was in a man of sixty-five in whom a penetrating epithelioma had developed in the course of two years involving the right parietotemporal region and extending into the deep tissues. The superficial part of the tumor was removed and the rest treated as in the previous cases. In three months there was complete and permanent cure.

In the last case the epithelioma had developed on a stubborn lupus erythematosus and the radium treatment was preceded by coagulation and excision of the superficial part of the tumor by diathermia. Radium needles and a superficial apparatus were then used as in the other cases. The brilliant result is shown by photographs taken before and two months after treatment.

The cases show the great value of radium properly applied in the treatment of skin epitheliomas.—*Audrey G. Morgan.*

Schulte, G. Zur Röntgendosierung bei Hautkrankheiten. (Roentgen dosage in skin diseases.) *Strahlentherapie*, 1930, *36*, 132–135.

Recently a number of dermatologists have recommended decreasing the roentgen dosage in skin diseases. Thedering particularly recommends very small, almost homeopathic doses. The author disagrees with him in this and says that when he has decreased his doses he has always had poorer results. The large dosage shortens the time required for treatment and the time the patients must lose from their work. He follows the dosage table given by

Hans Meyer in Rieke's Lehrbuch der Haut und Geschlechtskrankheiten, though he considers these not average doses but maximum doses. He does not hold strictly to this scheme but individualizes the treatment. He agrees with Stühmer that 3 series of irradiations should be given with an interval of ten days between them. Fractioning and irradiation at irregular intervals should be avoided. Of course with the usual dosage the series must not be repeated too often. The patients are told that the irradiations cannot be repeated indefinitely and that they must take energetic prophylactic measures to prevent recurrence of the disease. But the author does not hesitate to give another complete cycle after two or three months or a year, though he tries to use somewhat smaller doses than before.

In cases in which the recurrence is only over a part of the original surface only this part need be irradiated. He has never had any early or late injury even when 3 complete doses were given in the time mentioned above. A normal dose is not a skin erythema dose. Because of the recovery of the skin between applications it remains considerably below the erythema dose. Though he has found that 3 full doses in a minimum time of 1¼ years are harmless he carefully tests the capillary system before each new cycle.—*Audrey G. Morgan.*

Bruner, Edward. Zur Behandlung der Röntgenulcerationen der Haut. (Treatment of roentgen ulcers of the skin.) *Strahlentherapie*, 1930, *36*, 373–384.

Treatment of roentgen ulcers is very difficult. Operation is necessary in some cases because of the unendurable pain, but conservative treatment, though it requires great patience on the part of physician and patient, is sometimes successful, even in large and stubborn ulcers. Treatment must be strictly individual for it is impossible to see how the injured skin will react to any given drug or method. This applies even to neutral salves, such as zinc salve, zinc-bismuth salve, boric acid salve, etc. The author has often found that an ulcer that responded well to boric acid salve became more painful and extended on zinc salve. Radium ulcers are particularly painful and do not bear neutral salves or compresses well. In such cases the author has used a mixture of oil and wax (1:6) with excellent results; this never caused irritation of the skin and always relieved the pain. The addition of anesthetics to the salves does not give the desired result but often on the contrary makes them slightly corrosive. The author has used 1 per cent rivanol salve with success. It is particularly useful as a bactericidal agent in infected ulcers.

Among the physical agents he has used the rays of the sollux lamp and ultraviolet rays in the form of local and general quartz lamp irradiation, and the concentrated light of the large Finsen lamp as local irradiation. Of course such treatments must be used carefully for the injured skin is very sensitive and readily breaks down under any kind of irritation. Special care must be exercised in the local use of the quartz lamp but the author warmly recommends general use of the quartz lamp with the injured parts covered.

Reyn used Finsen light for the treatment of roentgen ulcers and the author tried it and found it very successful. He began with one minute of irradiation applied to the edges of the ulcer and the comparatively normal skin around it. The patients gradually became accustomed to it so that it could be increased to ten to fifteen minutes. The method takes a great deal of time but so does any other method of treatment of roentgen ulcers. One of its greatest advantages is that it stops the pain quickly.

Illustrative cases of these different methods of treatment are described.—*Audrey G. Morgan.*

Kelen, Béla. Uber Spatröntgengeschwüre. (Late roentgen ulcers.) *Strahlentherapie*, 1930, *36*, 116–126.

In the beginning of roentgen therapy when the technique was not very good, roentgen ulcers often occurred. It is now known that they are caused by cumulative action of the rays. It is hard to get statistics in regard to late roentgen ulcers for naturally authors do not like to report them when they might be blamed for lack of care. The number varies with the different periods of roentgen technique. The ulcers are always preceded by telangiectases. All the patients in the first period when unfiltered erythema doses were used showed more or less extensive telangiectases. In the period when higher tension currents and smaller doses were used the telangiectases were milder. In these two periods together the author treated 290 patients and 4 of them had ulcers, or 1.38 per cent. In the period when 3 mm. aluminum filters

were used 2950 patients were treated and telangiectases occurred only in those that were treated a long time; 8 of these patients had late ulcer, or 0.27 per cent. In one case the ulcer developed thirteen years after the treatment. In the period when ultra high tension was used with zinc filter and pigmentation doses there were no telangiectases and no late ulcers.

The author believes therefore that late ulcers are not incalculable and unavoidable results of roentgen treatment. Like early ulcers they are the result of overdosage but early ulcers are caused by giving more than the maximum dose, while late ulcers are caused by too frequent doses at too short intervals, even if the limits of tolerance are not exceeded. Late ulcers are not a direct result of irradiation. They are preceded by telangiectases which may improve, remain stationary or develop into ulcers. Telangiectases can be prevented by giving the correct doses at the proper intervals. A full erythema dose should not be used and a skin area that has shown erythema should not be irradiated again. And a region that shows telangiectases should not be irradiated again. In order to prevent late ulcers, the intervals between irradiations should be as long as possible, but if they are too long the object of the treatment is defeated. The author thinks that an interval of six weeks between irradiations does not interfere with their action if sufficiently penetrating rays are used. Of course the roentgenologist does not want to prevent cumulation; the object of roentgen therapy is to bring about a cumulative action more intense in the diseased cells than in the normal ones. By the use of six week intervals, three irradiations and doses within the limits of tolerance the cumulation can be kept within boundaries that insure recovery in six months. After three irradiations a new series should not be given in less than six months.—*Audrey G. Morgan.*

Thedering, Franz. Ueber Röentgendosierung in der Hautpraxis. (Roentgen dosage in dermatology.) *Strahlentherapie*, 1930, *36*, 127–131.

The author has found that irradiation divided into many small doses is more effective than the same amount given in a single large dose. This has been confirmed by the biological work of Kahlstorf on the effect of fractional roentgen irradiation of *Ascaris* ova. In chronic eczema he has found that one irradiation a week gives good results. The filter and tension depend on the thickness of the eczema infiltrate; spark gap 18 to 20 cm., filter 0.5 to 3 mm. aluminum. The single dose is not over 0.1 to 0.3 X. As the usual physical and medical treatments are also used in chronic eczema 3 or 4 such doses are generally enough. An acute skin disease reacts to roentgen treatment with a steep curve, while a chronic one like tuberculosis reacts with a long wave-like one. Therefore acute diseases should be treated more frequently and with very small doses, while chronic ones should be irradiated with longer intervals and somewhat larger doses. Skin tuberculosis should be irradiated about twice a month under a 2 to 4 mm. aluminum filter with not more than 0.1 to 0.5 X, while chronic diseases that show a livelier reaction may be irradiated at intervals of a week or two with 0.1 to 0.3 X under a filter of 0.5 to 3 mm. aluminum.

Maupertius says that nature always works with the least expenditure of energy and this law should be applied in the roentgen treatment of skin diseases. A dose should never be given that is larger than the minimum dose required for the purpose, it should not be applied a single time more than is necessary to attain the purpose and the intervals between treatments should never be short enough so that cumulation can cause any injury of the skin.—*Audrey G. Morgan.*

Fukase, Shuichi. Ueber die Beeinflussung der Wundheilung durch Röntgenbestrahlung. (Effect of roentgen irradiation on wound healing.) *Strahlentherapie*, 1930, *36*, 102–104.

In order to determine whether roentgen irradiation furthers the healing of wounds, the author made skin incisions 10 cm. long on the backs of 14 young rabbits and irradiated half of the length of the wounds without suturing them. The unirradiated halves were protected with sterilized lead. The dose was 8 H with 170 kv. (400 R). In all 14 cases the irradiated halves of the wounds healed by first intention, while the non-irradiated halves healed by second intention. There is some disagreement as to the mechanism of action of the rays but the author thinks they prevent the local connective tissue cells from developing into inflammatory cells. That the action is a local and not a general one is shown by the fact that the immediately contiguous non-irradiated tissue is not affected.—*Audrey G. Morgan.*

Steiner, Georg. Erfolg der Röntgentherapie bei Hirntumor seit 2 Jahren controlliert. (Results of roentgen treatment in brain tumor under observations for two years.) *Strahlentherapie*, 1930, *36*, 193–196.

A patient thirty-three years of age came for treatment with the symptoms of a brain tumor in the right frontal region. She was given 3 series of treatments from December, 1927 to March, 1928, with 135 kv. through 0.3 mm. copper and 1.0 mm. aluminum. Three fields were irradiated from a distance of 23 cm., with a dose of 8–10 H per field. On March 8 the choked disc on both sides, particularly the right, had become considerably smaller, the subjective symptoms were considerably improved, the disturbance of gait was still present but improved. In May, 1928, another series was given from 3 fields. As there was still slight disturbance of gait another series of 3 fields was given Nov. 1, with 175 kv., 28 cm. distance, through 0.5 mm. zinc and 2 mm. aluminum, which was about 520 R per field. In March, 1929, the gait had become almost normal and the patient could do her housework. The last examination on Nov. 8, 1929, showed the choked disc almost disappeared; both discs were slightly atrophic and the boundaries indistinct; vision on both sides 6/6; visual fields normal. A picture in 1929 showed the dorsum of the sella somewhat broader than before. The patient's psychic condition is good.

The disappearance of the choked disc is a sign of lowering of the high intracranial pressure but the effect of the roentgen treatment could not be attributed solely to that, as shown by its long continuance and the fact that the localizing symptoms were also improved. In addition to the decrease of pressure there must have been at least a partial retrogression of the tumor, which was probably a glioma rich in cells.

The author also mentions the good effect of roentgen treatment in a case of Menière's complex with a suspicion of cerebellopontile tumor and advises roentgen therapy in such cases.—*Audrey G. Morgan.*

Vischia, Quintino. Radio-diagnostica e radioterapia dei tumori della ghiandola ipofisaria. (Roentgen diagnosis and roentgen therapy of tumors of the hypophysis.) *Radiol. med.*, Apr., 1930, *17*, 409–433.

The clinical and roentgen symptomatology of various hypophyseal syndromes are described. In tumors of the hypophysis the sella is enlarged and deepened, the distance between the anterior and posterior clinoid processes is increased and they are flattened and the fovea of the sella is deepened. These changes take place at the expense of the sphenoid sinus, which is greatly reduced in size or may even disappear entirely.

Two clinical cases are described and the pathogenesis and prognosis of tumors of the hypophysis discussed in connection with them. The author thinks that roentgen therapy is to be preferred to surgery of these tumors and the results of roentgen therapy are better the earlier the diagnosis is made; treatment should be given in the stage when the tumor has only caused signs of compression. But even in late and inoperable cases roentgen treatment may stop the progress of the process. The eye symptoms particularly are improved by roentgen treatment if it is given in time. The author has even succeeded in bringing about restoration to normal of the sella turcica in a blind patient who recovered his sight. These results are explained on the theory that roentgen irradiation stimulates a zone in the diencephalo-hypophyseal region which controls calcium metabolism. This is only a hypothesis and other students of the subject say that after roentgen treatment of the hypophyseal region in pathological conditions the amount of calcium in the blood is lowered. But at any rate the existence of a center that regulates calcium metabolism is demonstrated.—*Audrey G. Morgan.*

Hoffmann, Wolfgang. Ueber Augenschutz bei Anwendung von Röntgen- und Radiumstrahlen. (Protection of the eyes in using roentgen and radium rays.) *Strahlentherapie*, 1930, *36*, 105–115.

Cases of cataract and glaucoma and even panophthalmia have been seen after irradiation of the eye region so the eyeball should always be protected. If possible the plan of irradiation should be such that the rays do not strike the eye, but this is impossible in irradiation of the eyelids or conjunctiva, so attempts have been made to protect the eye by placing some substance that absorbs the rays well in the conjunctival sac. Fr. A. Müller devised prostheses 1 mm. thick made of leaded glass which were sold in various shapes and sizes. These did not prove as effective as they were calculated to be though for the secondary irradiation from the

lead increased the dosage of rays that acted on the eyeball. Stumpf noticed this defect and tried to avoid secondary irradiation by using ordinary glass with a glycerin filling. This does not protect so much by absorption as by increasing the distance between the lid and the eyeball. But if the prosthesis is more than 4 to 5 mm. thick it cannot be placed in the conjunctival sac. And with hard irradiation and a field of 6×8 cm., 5 mm. does not do much good.

In order to be effective a prosthesis should protect the greater part of the eyeball, particularly the important parts, such as the ciliary body and lens. It must make it possible to irradiate a part of the surface and protect the rest. It must also be easy to put in and take out and not cause any mechanical or other injury. It must be easy to clean and keep clean and not easy to break. The protective action of a shell decreases with increasing hardness of the rays and size of the field. The author has not found paraffin shells very good as they break easily and become soft in the conjunctival sac and change form. He thinks that hard rubber, ebonite or some other resinous substance with a higher melting point and great hardness, celluloid or even ordinary glass that does not contain lead or barium, is to be preferred to paraffin, particularly celluloid, for it can be given any form by dipping it in hot water.

The protective action of the shells decreases with increasing distance from the skin. The amount of irradiation that passes through a paraffin prosthesis 3 mm. thick at the vertex of the cornea, root of the iris, pole of the lens and macula at 1 cm. distance is 66, 70, 77.5 and 85 per cent and at 2 cm. distance 78.5, 80, 83.6 and 86.6 per cent. The protective shells have only very limited value for gamma radium rays. Their effect with these rays is due more to increased distance than to absorption. For this reason thick prostheses are better than thin ones and ones made of material with a low atomic weight better than ones of material of high atomic weight.

This does not mean, however, that the protective prostheses are useless. There are many cases in which they can be used with advantage but their protection should not be counted on to relieve the physician of the necessity of working out a plan of irradiation that will spare the eye if possible.—*Audrey G. Morgan.*

Jendralski, Felix. Beitrag zur Röntgenbehandlung chronisch entzündlicher Erkrankungen des Auges. (Roentgen treatment of chronic inflammatory diseases of the eye.) *Strahlentherapie*, 1930, *36*, 327–336.

The author finds from his experience that the healing of indolent inflammations of the cornea is furthered by roentgen treatment. In diffuse tuberculous inflammation of the cornea irradiation is effective, though often only temporarily so. In syphilitic parenchymatous keratitis irradiation does not prevent progress of the inflammation and the author does not have as favorable an impression of its results as many others seem to have. However he did have good results in 3 very severe cases and he was not able to carry out the treatment as intensively and regularly as some other physicians have done. In scleritis the results of irradiation are excellent; the inflammation is cured and complications such as keratitis, scleral staphylomas, etc., prevented. In disseminated chroiditis, the individual foci seem to be healed more quickly than by other methods of treatment. Further growth of isolated tuberculomas is prevented, their retrogression hastened and further destruction of tissue avoided.

The majority of the author's patients were irradiated with the Radiotransverter of Koch and Sterzel, metroelectron therapy tube of Müller at 30 cm. distance with a filter of 3 mm. Al, 4 ma., 22 cm. parallel spark gap. The dose was generally ½ ND, Sabouraud-Noiré, in some cases of inflammation of the cornea and scleritis ⅓ ND. In future he will use the smaller dose in cases with a rapid course and tendency to recurrence, that is, in many inflammations of the cornea and scleritis and will shorten the intervals between treatments from four weeks to two or three. The number of irradiations depends on the course of the disease. The roentgen treatment did not have any injurious effect on the eye in any of his cases.—*Audrey G. Morgan.*

Simmons, Channing C. Cancer of the buccal mucosa; results of treatment by operation and radiation. *Ann. Surg.*, Oct., 1930, *92*, 681–693.

The author reports a series of 387 cases observed and treated by irradiation and surgery during the years 1921 to 1923, and followed not less than five years. In speaking of a case as

cured the author accepted the standard of the Committee on Cancer of the American College of Surgeons. The groups studied were cancer of the tongue, floor of the mouth, cheek, palate, upper and lower jaw, and tonsils. The paper is statistical and does not lend itself to a short abstract. It is distinctly worth while. The author's conclusions are as follows:

1. The results of treatment of carcinoma of the mouth by surgery and radiation at the Collis P. Huntington and Massachusetts General Hospitals for the years 1921–1923 were similar to those obtained in the three preceding years, although the results following radiation treatment were somewhat better, probably due to improved technique.

2. In primary cases without clinical evidence of metastases, surgical treatment offers 40 per cent chance of a five-year cure as against 8.5 per cent by irradiation.

3. In primary cases with clinical evidence of metastases radiation treatment offers no chance of permanent cure, and operative treatment 30 per cent. These figures are hardly fair, however, as only the most favorable cases were submitted to surgical treatment. On the other hand, no cases were cured by radiation.

4. Postoperative prophylactic roentgen treatment had no effect in preventing recurrence.

5. Of the primary cases dying of recurrence, life was prolonged by treatment but life is longer following surgical treatment than radiation treatment.

6. In the recurrent cases dying of disease and in inoperable cases, life is distinctly prolonged by radiation treatment.

7. The patients consulted a physician somewhat earlier and the diagnosis was made more promptly than in the preceding group.

8. Other factors being equal, the prognosis depends on the degree of malignancy of the tumor as determined on microscopic examination.

9. The mucous membrane of the mouth in certain individuals seems to be prone to undergo malignant changes, and multiple cancer is not uncommon.—*E. P. Pendergrass.*

Estapé, José Maria. Double syndrome de Basedow et de Mikulicz et psychose basedowienne. (Double syndrome of Basedow and Mikulicz and basedowian psychosis.) *Rev. sud-am. de méd. et de chir.*, July, 1930, *1*, 721–722.

The author describes briefly a case of Basedow's disease associated with the Mikulicz syndrome, occurring in a girl twenty-five years of age. The Basedow's disease was treated by roentgen irradiation with entire disappearance of the symptoms. The symmetrical hypertrophy of the salivary and lacrymal glands has persisted. The interesting feature of the case is the association of the two conditions.—*T. Leucutia.*

Bardachzi, Franz. Zur Roentgenbehandlung der Basedowschen Krankheit. (Roentgen treatment of Basedow's disease.) *Strahlentherapie*, 1930, *36*, 173–178.

Some cases of Basedow's disease do better under medical, some under surgical and some under roentgen treatment, and some under a combination of the different methods. But roentgen therapy has become as indispensable a part of the treatment as surgery. Operation should be used in cases of goiter with signs of compression and in those that are refractory to roentgen treatment; as the action of the rays does not begin to appear until after some weeks, judgment should not be passed on the results of the treatment in less than six months. Irradiation should be given in inoperable cases and to patients who are afraid of operation and also in cases in which it is evident that operation would be dangerous. Statistics show 50 to 60 per cent cure and 30 to 45 per cent improvement for both surgery and irradiation so there is not much difference in that respect. Results are more rapid on operation. Irradiation with the correct technique is free of danger and the mortality after operation is 3–4 per cent. There is about 20–30 per cent recurrence after surgery and 10–20 per cent after irradiation. The bad results that have been reported from irradiation are chiefly due to defective technique.

Dosage must be very carefully watched in Basedow's disease. In acute severe cases the author begins with 10 per cent of a skin erythema dose and then waits till the reaction has passed off; then the dose is repeated or increased a little until $\frac{1}{2}$ a skin erythema dose has been given in the course of three to four weeks. In less severe cases he begins with $\frac{1}{4}$ to $\frac{1}{3}$ of a skin erythema dose and repeats it after three to eight days, depending on the severity of the case. If there is a reaction, the next dose must be decreased and not given until the reaction has passed off. A second series is given after six

weeks. In order to avoid all danger the larynx is protected after 50 per cent of a skin erythema dose has been given. The author thinks it is unnecessary and dangerous to give more than $\frac{2}{3}$ of an erythema dose in a series. He uses a Stabilovolt apparatus, 170 kv., 6 ma., 0.5 mm. Cu filter and 50 cm. distance. The desired effect generally begins after the first series; but sometimes more than the two series must be given. In that case he covers the larynx after more than half an erythema dose has been given. Severe and moderately severe cases should be treated in a hospital where the necessary internal treatment can be carried out carefully. —*Audrey G. Morgan.*

Rieder, Wilhelm. Kritisches zur Röntgenbestrahlung des Morbus Basedowii. (Roentgen irradiation in Basedow's disease.) *Strahlentherapie*, 1930, *36*, 64–87.

Since the first American reports on the success of roentgen treatment in Basedow's disease, the leaders of the Vienna school of roentgenology, Holzknecht and Schwarz, and also the German roentgenologists have been trying the method. The reports have been contradictory, probably because different kinds of material were used. To get any idea of the value of roentgen therapy as compared with internal and operative treatment, it would be necessary to have statistics in regard to the results of the three methods used on the same kind of material. Such statistics are available from the Imperial Hospital in Copenhagen. They show that among 86 Basedow patients given internal treatment alone, 33.8 per cent were cured or almost cured, 14.3 per cent improved, 19.5 per cent unchanged and 32.4 per cent died of the disease. Among 127 patients treated with roentgen irradiation 45.9 per cent were cured or almost cured, 19.7 per cent improved, 18.8 per cent unchanged, and 15.6 per cent died of the disease during treatment or later. Among 130 operated cases, 71.5 per cent were cured or almost cured, 13.1 per cent improved, 10 per cent unchanged and the mortality was 5.4 per cent. Operative treatment, therefore, according to these statistics, was very much superior to either of the other methods. The objection made by roentgenologists that the operative mortality is high in surgical operation is no longer true nor is their claim that there is no mortality in roentgen treatment true. A number of cases of death are cited from the literature.

The author describes his own cases of Basedow's disease treated by roentgen irradiation, giving curves showing the effect of the irradiation on pulse, weight and basal metabolism and descriptions and illustrations of the histological findings. In severe cases of Basedow's disease there was very little effect except in one case in which there was improvement. The rays are supposed to injure the gland cells so that their secretion decreases. There was no histological evidence that this occurs. The author concludes therefore that roentgen treatment has very little effect in severe Basedow's disease. Irradiation may be tried in the beginning in mild cases, in inoperable cases and cases in which the patients refuse operation. All other cases should be operated on. If irradiation is not effective, it should not be carried on longer than four months or the best time for operation may be past. The iodine treatment is superior to roentgen therapy as a preliminary treatment before operation.

The author thinks the statistics given by some roentgenologists are so favorable because their cases were mostly mild or moderately severe or cases of glandular neurosis.—*Audrey G. Morgan.*

Hayer, E., and Hufschmid, W. Röntgenbehandlung der Thyreotoxicoses. (Roentgen treatment of thyrotoxicoses.) *Strahlentherapie*, 1930, *36*, 477–490.

Statistics of recent years show that the results are about the same with roentgen or surgical treatment of thyrotoxicoses; about 50 to 80 per cent are cured with each method of treatment. The authors have given roentgen treatment in 114 cases of all degrees from slight thyrotoxicosis to pronounced Basedow's disease. They irradiated two neck fields at an angle of 45° to the horizontal plane and a large thymus field reaching to the middle of the sternum, the other fields being covered when one was irradiated. They never saw any injury of the irradiated region. The size of the dose depended on the basal metabolism. Generally they began with 10 per cent of an erythema dose and after two weeks when this was well borne they gave a dose of 15 to 20 per cent. After two to three more weeks they gave a third series of 25–30 per cent.

They divide their cases into 47 which were treated more than a year ago, 53 that have been under treatment more than three months and

19 that have been under treatment for less than three months. Nineteen of the 47 cases of the first class are counted out because they died or had been operated on, so they cannot be counted as cases of pure roentgen treatment. Of the remaining 28 there are 21 that are cured or so greatly improved that they can do their work. This gives 77.8 per cent cure. In the second class of 53 cases 10, or 18.2 per cent, were cured; 29, or 52.7 per cent, improved, and 16, or 29.1 per cent, unimproved. In the third class there has been improvement in 83.3 per cent of the cases and no improvement in 16.7 per cent, showing in what a short time many of these cases improve under roentgen treatment.

The cases show that roentgen treatment is of value in thyrotoxicoses. Roentgen treatment sets free more toxins and products of disintegration in the body than operation so that large doses are injurious at first. The first thing necessary is to see that the patient bears the irradiation well and that his symptoms do not increase. The patient should be kept under clinical observation and in severe cases in the hospital. In addition to suitable diet and heart tonics he should be given sedatives at first. Generally within three months he can be dismissed from the hospital and given ambulant treatment. The milder cases are cured by that time but they should be kept under observation for recurrence is possible. There are often psychic factors involved also and those patients who live under good hygienic and economic conditions are safer from recurrence than ones whose lives are more difficult.

The authors believe that all cases of thyrotoxicosis except those with threatening symptoms should first be given a roentgen treatment. The results can be judged in a relatively short time and operation can then be performed if necessary.—*Audrey G. Morgan.*

Jugenburg, Anna. Unsere Methode der Röntgenbehandlung der Basedowschen Krankheit bei älteren Fraune. (Our method of roentgen treatment of Basedow's disease in elderly women.) *Strahlentherapie*, 1930, *36*, 491–502.

Among 160 cases of Basedow's disease there were 5 deaths. These cases are described. They were all in women at or near the climacteric. Some of these patients were in such bad condition when admitted that roentgen treatment was hopeless. But in most of the other cases in elderly women the results of roentgen treatment were not very good. Two cases are described in which the ordinary roentgen treatment of the thyroid and the thymus region had practically no effect. It is these cases in elderly women that decrease the percentage of good results in Basedow's disease. The reason for this is that Basedow's disease in the climacteric is not solely a disease of the thyroid. There is a general disturbance of endocrine balance due to the loss of ovarian function and the function of the hypophysis is also affected. The author therefore tried irradiating the hypophysis in cases in which irradiation of the thyroid and thymus did no good. Four fields 6×8 were irradiated—the temporal region on both sides, the forehead and the bregma region. The rays were filtered through 0.5 mm. zinc and 3 mm. aluminum. The dose was smaller than in tumors of the hypophysis, $\frac{1}{3}$ of an erythema dose to each field. Only one field was irradiated at a time with an interval of one or two days between irradiations. The patients often complained of headache and fatigue immediately after the irradiations but this soon passed off and the Basedow symptoms improved. In many cases there was a decrease of basal metabolism in five or six days. In two to four months most of the patients were able to work. A number of illustrative cases are described, including one in a woman of thirty-eight with severe Basedow's disease and normal menstruation. The disease was very severe, and irradiation of the thyroid and thymus had been ineffective. In this case the Basedow's disease had developed immediately after pregnancy. Evidently the pregnancy and its endocrine disturbance had caused the severity of the Basedow's disease.—*Audrey G. Morgan.*

Dautwitz, Fritz. Ueber Radium Bestrahlung der Struma maligna. (Radium irradiation of malignant goiter.) *Strahlentherapie*, 1930, *36*, 32–50.

The author discusses the literature of the subject and the 25 cases of malignant goiter that he himself has treated with radium. His patients were in an advanced stage of the disease when radium treatment was begun. Seven of them already had metastases, or 28 per cent. Fourteen were inoperable and one of these had metastases. The other 11 had inoperable recurrences and 6 of these had metastases. The metastases were in the regional and mediastinal lymph glands, the lungs and the lumbar spinal column.

Three of them had hemoptysis because the tumor had extended to the trachea. Metastases from malignant goiter grow very slowly.

The author used gamma irradiation, part of it from plates up to 6 cm. in diameter and part of it from tubes containing about 40 to 90 mg. radium. The radium carriers were located 1 to 3 cm. from the skin, in some cases in a cross-fire position. A single irradiation was generally kept up for six to twelve hours. In one case in which even slight pressure on the throat caused loss of consciousness the radium carrier could only be applied for 3½ hours at first, but this patient was still alive thirteen years later, after having been given 22,850 mg-hr. radium in 7 series. The applications of radium are generally given every day or every other day. Four to 6 treatments form a series, which may be repeated if necessary, but after an interval of not less than two months. The average total dose in inoperable cases is 10,892 mg-hr. radium, in recurrences 12,731 mg-hr. The highest total dose in a series in the former class of cases was 18,343 mg-hr., in the latter 10,460 mg-hr. The patient who was given the former dose was first irradiated in July, 1912, and died in September, 1923; the other patient was irradiated in the beginning of 1922 and was still living and well in May, 1929. There was severe injury of the skin in only one case and it is questionable whether the radium irradiation was solely responsible for this. The patient had been irradiated repeatedly with roentgen rays and given thorium X injections which had made her skin so sensitive that it ulcerated after the first series of irradiations with pure gamma rays. The roentgen rays may have helped to cause the shortening of the muscles on the right side of the neck which held the head in an abnormal position and they doubtless caused the anisocoria. Some of the patients who had been irradiated for a long time have slight atrophy of the skin and some telangiectases but they were insignificant. One patient had been operated on once for recurrence of an adenocarcinoma of the thyroid and came for treatment with a metastasis in the third lumbar vertebra; her periods had been irregular before that but after the first series they came on after a period of fourteen days and again afterwards a week too early. Irradiation of the thyroid generally causes suppression or retardation of the menses, but in this case there was a stimulation, probably caused by the irradiation of the third lumbar vertebra, from which site small amounts of irradiation must have reached the ovary.

Except in one inoperable patient seventy-one years of age who died on the third day of the radium treatment, the irradiation had a good effect in all cases, even when the patients died within six months. The tumors decreased in size and became smaller, the pain and stridor stopped, the hoarseness, dyspnea and difficulty in swallowing were alleviated, appetite and sleep improved and the patients gained weight. Of the 14 inoperable patients, 6 died in the course of the first year, one of them of apoplexy, one each died in the second, third and eleventh years and one patient is still living fourteen years after the treatment. One was reported dead without any time being given and there was no answer to the inquiries in 3 cases, but this does not necessarily mean that they were dead. Of the 11 patients with recurrence, 3 died in the year following the radium treatment and one four years later; one is still living in the second year, three in the fourth year and one each in the sixth, eighth and twelfth years. The patient mentioned above with a metastasis in the spinal column, who in the beginning of treatment could hardly walk with a supporting corset, is not only living after 3 series of irradiations but can walk without support.

In all of these 25 cases the prognosis was very bad yet 9 of the patients lived or are living more than three years.—*Audrey G. Morgan.*

Schönfeld, Herbert, and Baumbach, Gottfried. Die Röntgenbehandlung des kindlichen Rachenringes. (Roentgen treatment of the lymphatic pharyngeal ring in children.) *Strahlentherapie*, 1930, *36*, 472–476.

The authors have given roentgen treatment for the tonsils to about 150 children from three to thirteen years of age in the past three years. They used hard rays; 180 kv. (Stabilivolt, AEG tubes), filter 0.5 mm. Cu and 1 mm. Al, tube 6×8, but the size of the fields was restricted according to the age of the child. On each side of the neck a bundle of rays was directed forward and upward from beneath the angle of the jaw. This gave an approximately homogeneous irradiation of the whole pharyngeal lymphatic ring. Not only were the pharyngeal and palatal tonsils irradiated but also the rest of the lymphatic tissue of the region. The dose applied to the lymphatic pharyngeal ring was 30–50 per cent, or at most 60 per cent of an erythema

dose. At first the two fields were irradiated on two successive days but afterwards both were irradiated at the same time when it was found that this could be done without harm. A second irradiation is given not less than four weeks after the first and if necessary a third one four weeks after the second. Generally not more than three irradiations are needed. The children were kept under observation when possible for two or three years and the tonsils were examined histologically; 106 of the children were followed up. In 60 of the children (57 per cent) the tonsils decreased considerably in size, in 41 of the cases to normal. In 43 per cent of the cases there was no great reduction in the size of the tonsils. On reexamination two to three years after the treatment the tonsils were smaller than before treatment in only 43 cases, or 41 per cent; there had been recurrence in 28 per cent of the cases. But the symptoms were overcome not only in the cases in which the size of the tonsils was decreased but in about half of the others and the children no longer showed the tendency to recurrent sore throat that they did before treatment.

American authors report good functional results in 90 per cent of the cases. Their better percentage may be due to the fact that they irradiated adults, while the authors' patients were all children, whose lymphatic tissue regenerates much more readily than that of adults. On reexamination the authors never saw any signs of chronic injury of the mucous membrane or disturbance of gland function in the mouth and pharynx. Nor did they see any evidence that adhesions had been brought about that would interfere with later operation if it became necessary. They think roentgen treatment is indicated in cases of hypertrophy of the tonsils with frequent recurrences of infection of the pharynx.—*Audrey G. Morgan.*

Zipperlen, Victor R. Röntgenbestrahlung bei Asthma bronchiale. (Roentgen irradiation in bronchial asthma.) *Strahlentherapie*, 1930, *36*, 88–94.

Schilling, in 1906, was the first to report improvement in asthma after roentgen irradiation. The author tried irradiation at his clinic but was dissatisfied with the results and gave it up. But five years ago he again began to irradiate cases of asthma systematically. Fifteen of his patients were cured, or 27.78 per cent, 15 considerably improved (that is, they only have an attack about every two months), 15 were improved, that is, there was a decrease in the number and severity of the attacks, and there was no effect in 9 cases, or 16.66 per cent. Irradiation therefore had a good effect in 83.34 per cent of the cases. In addition to the roentgen treatment the usual methods of treatment are used. He prefers the small field method, that is, he irradiates one field in front from a distance without protecting the heart and four small fields behind and also the spleen from in front, giving $\frac{1}{3}$ skin erythema dose on each field. —*Audrey G. Morgan.*

Freund, Leopold. Die Strahlenbehandlung von Erkrankungen des Herzens. (Radiotherapy of diseases of the heart.) *Strahlentherapie*, 1930, *36*, 516–519.

In 1906 the author reported the case of a young girl suffering from insufficiency and stenosis of the mitral valve; he irradiated her 6 times for six minutes each with roentgen rays. Her blood pressure, which had been very low, rose and she said that she felt better subjectively. Her blood pressure fell but rose again when she was again irradiated four weeks later. Her subjective condition improved so greatly that she was able to sail for America. She has written twice that she is in good condition.

Other cases are reported of good results in angina pectoris and disturbances of compensation with the mercury vapor quartz light and with ultraviolet irradiation.

The mechanism of action of the roentgen rays on the heart has been studied in recent years. Experiments made by Zwaardemaker and Feenstra showed that a heart that had stopped on perfusion with potassium-free Ringer's solution was reactivated by cathode rays and in a third of the cases pulsated for seven hours. Under the influence of very soft roentgen rays the immediate effect was less but it continued longer. Animal experiments have shown that the function of the heart muscle can be influenced by intensive roentgen irradiation without any clinical signs of injury to the heart. It is possible that products of irradiation in the blood affect heart action.

The author's single case is not conclusive but he has recently read reports of a number of other authors on good effects from roentgen irradiation in organic heart diseases.—*Audrey G. Morgan.*

Heyman, James. Radiology as a complete or partial substitute for surgery in the treatment of cancer of female pelvic organs. *Surg., Gynec. & Obst.*, Jan., 1930, *50*, 173–183.

The author discusses the interrelation between surgical and radiological treatment in cancer of the female organs.

In cancer of the cervix, he feels that radiological treatment is the method of choice. This is based on a sufficiently large group of cases that have been followed for a period of five years. A comparison shows the surgical five year cure rate on a series of cases of which 54.6 per cent were operable to be 19.1 per cent, while in a series of cases in which only 25.5 per cent were operable, 20.6 per cent showed five year cures when treated radiologically. Statistics presented by Ward, Schmitz, and Regaud point in the same direction. Since 1920, only a small number of cases of cancer of the cervix have been operated on in Sweden. The author feels that surgery in early cases followed by postoperative radiation treatment is not as good as using radiation treatment only. He feels that where radiation treatment has failed, then surgery is the method of last resort. He states that surgery is not made more difficult by previous radiation treatment. He has tried surgery after radiation treatment in only 50 cases in fifteen years.

In making a comparison of the two methods of treatment of carcinoma of the body of the uterus, the author states it is difficult because the available material is small and because the microscopical diagnosis is difficult. However, the author feels that operable cases should be operated on. In cases in which the uterine cavity is narrow and one can expect uniform contact between the radium container and the uterine wall, the patient is irradiated and kept under close observation. If no improvement is noticed in from three to four months, hysterectomy is performed. This procedure does not incur any greater risk nor does it make operation any more diffieult. If the uterus is large and dilated, radium treatment is not as good, and the author prefers to operate and irradiate afterward. Inoperable cases should be irradiated and the author states that they have had five year cures in 26.9 per cent of these cases. Operated cases for carcinoma of the body should be irradiated postoperatively, because the percentage of cures in these cases is 79.3 per cent in contrast to those operated only, in which the cures are only 58.8 per cent.

In carcinoma of the vagina, irradiation is the treatment of choice. He feels that this cure rate of 21.4 per cent is remarkably good.

In the treatment of carcinoma of the ovaries, intimate cooperation between surgical and radiation treatment is required. Surgery should be used to remove the ovarian tumors, but whether it is radical or not, it should be followed by irradiation. In other cases, irradiation first will cause reduction in the size of the tumor and pave the way to a successful operation. He feels that inoperable cases should be irradiated.

The paper is discussed by Dr. Henry Schmitz, of Chicago, who gives the contraindications for surgery and radiation treatment of cancer of the pelvic organs. Operability depends on: (1) normal mobility; (2) patency of the cervical canal; (3) afebrility of patient; (4) absence of pathogenic bacteria in central canal; (5) good surgical risk. The absence of any one of these, contraindicates surgery. Contraindications for irradiation are: (1) general emaciation of cachexia; (2) anemia with cell count below 3,500,000 and hemoglobin below 50 per cent; (3) impaired nitrogen metabolism; (4) complications in urinary or rectal tract; (5) the frozen pelvis; (6) the presence of inflammation or foul slough; (7) amenorrhea and pregnancy.

Dr. Arthur H. Curtis, in his discussion, adds that diathermy has proved to be a good aid in radiation treatment. He also advises wide treatment of the lesion with radium and also suggests fixation of the bladder and rectum in selected cases, to afford better irradiation of carcinoma of the cervix.—*Vincent Johnson.*

Voltz, Friedrich. Die unterstützenden Methoden Strahlenbehandlung der weiblichen Genitalcarcinome. (Supplementary methods in irradiation of carcinoma of the female genitalia.) *Strahlentherapie*, 1930, *36*, 51–63.

The literature in recent years has shown that surgery can be replaced by radiotherapy in the treatment of carcinoma of the female genitalia. The results of radiotherapy are as good as or better than those of surgery; in inoperable cases radiotherapy gives 15 per cent permanent recoveries. But the results should be improved still further and there are a number of ways in which this may be accomplished. They may be improved by methods related directly to the

method of treatment and by methods related only indirectly to it. Among the direct methods are those designed to increase the sensitiveness of the carcinoma cells, such as irradiation of the hypophysis and dextrocid treatment, and local methods of preparing a better field for the action of the rays, such as fulguration and cauterization; cataphoresis with copper is another of these methods. Among the indirect methods are improving the quality of the material by propaganda for early diagnosis and methods of improving the patient's general condition, including postoperative treatment.

Sensitization of the carcinoma cells makes it easier to destroy them without injuring the normal tissues. In a series of cases in which the carcinoma cells were sensitized by irradiation of the hypophysis the author had 23.3 per cent cures, as compared with 15.4 per cent in a series in which such sensitization was not brought about. A second method of sensitizing the cancer cells is by the injection of dextrocid, which produces secondary irradiation, so that the tumor is given a higher dosage of rays than the surrounding normal tissue. The author has had good results in the 629 cases in which he has used this method, but it is too early to give definite statistics. Local treatment by the electrocautery or by fulguration by means of diathermy prepares a better field for the action of the rays. The introduction of copper into the tumor by cataphoresis increases the capacity of the tumor for absorbing rays. In addition to the propaganda for early diagnosis, a definite plan of treatment should be established in each case and every effort made to have the patient complete the treatment. Often patients withdraw from treatment too soon because they feel well and so do not realize the importance of further treatment or because they cannot afford it. Better results are obtained in Radiumhemmet, Stockholm, where patients who cannot pay are treated free and even their expenses to Stockhom paid if necessary. The importance of after-treatment is shown by the much higher percentage of cures in patients who are in comfortable circumstances than among those who are poor and live under bad hygienic conditions. —*Audrey G. Morgan.*

Büben, Iwan V. Die Radiumtherapie des Scheidenkrebses. (Radium treatment of vaginal cancer.) *Strahlentherapie*, 1930, *36*, 503–509.

Among carcinomas of the female genital organs that of the vagina is most malignant and incurable. Fortunately primary carcinoma of the vagina is very rare, constituting only about 2 per cent of female genital carcinomas. Secondary carcinoma is much more frequent. From 1919 to 1929 the author's hospital treated 29 cases of cancer of the vagina, 28 of them by radiotherapy and only one by operation. Twenty-one of these patients were more than forty years of age and 8 of them younger. The youngest was twenty-seven, the oldest seventy-one. All were pavement epithelial cancers, which is the predominant form in cancer of the vagina. Occasionally adenocarcinomas are seen.

In the treatment of vaginal cancer the combined use of radium and roentgen rays is best, local treatment being given with radium and treatment of the glands with roentgen rays. Radium treatment of the vagina is difficult because the carcinoma soon grows through the thin wall of the vagina and if the irradiation is not given very carefully it causes rectal and bladder fistulas. The radium tubes must be strongly filtered and fixed in the vagina at a sufficient distance from the bladder and rectum. The dosage must be very careful. In the tumorous form of vaginal cancer when the process has not extended to the walls of the bladder and rectum the implantation method may be used. Radium needles, emanation tubes and thorium X rods can be used for implantation. Implantation cannot be used in the infiltrating form of vaginal cancer.

Among the 28 patients treated at the author's hospital in the past ten years 9 are still alive, one after nine years, one after six, one after four, one after two and 5 after less than two years. Two of the patients lived for three years, one for two years, three for one year; 12 of them died within a year and nothing is known of one. The 2 patients who have lived for nine and six years may be considered definitely cured. About the same percentage of cures is reported by other authors.—*Audrey G. Morgan.*

Lahm, W. Ueber Strahlenwirkung und Strahlendosierung nach Beobachtungen an vorbestrahlten Uteruscarcinomen. (Action and dosage of rays from observations on irradiated carcinomas of the uterus.) *Strahlentherapie*, 1930, *36*, 237–269.

Eighteen cases are described which were irradiated and afterwards operated on. The author studied them with a view to determining

the action on carcinoma of radium placed in the cervix. In order to know the effect of the rays it is necessary to know the picture before irradiation. He divides carcinoma of the uterus into three types: the first begins on one or both lips of the external os, grows into the cervical canal and surrounds it concentrically. The second begins apparently on the surface of the portio and extends to the lips. The third begins in the cervical canal and extends toward the body of the uterus or, less frequently, toward the portio. Diagrammatic sketches are given of these types before and after treatment. They show that the picture of the portio seen in the speculum gives little information as to the true extent of the carcinoma. Macroscopic examination of the uteri removed by operation after irradiation showed that the whole region that was the site of the carcinoma had been eliminated. This seems to show that radium irradiation accomplishes the same thing and no more than the thermocautery or the sharp curette. The theory that carcinoma tissue is stifled by proliferating tissue is disproved, for the connective tissue disappears too. Microscopic examination confirmed the fact that all the tissue infiltrated with carcinoma had disappeared.

It is impossible to say whether the stroma has been primarily injured so badly by the carcinoma that it as well as the carcinoma undergoes necrosis, whether, on the destruction of the carcinoma, substances are produced that destroy the tissue or whether tissue infiltrated with carcinoma has a different sensitiveness to the rays than the rest of the portio. It will require further examinations to settle these points.

Almost all of the cases were given 3600 to 4100 mg-hr. radium and a corresponding dose of roentgen rays. In all cases the uterus was extirpated four to seven weeks after the irradiation. The radium in all cases was placed in the cervix or in the tumor and vagina and irradiated uniformly in all directions. In all cases the carcinoma was destroyed and the normal tissue of the cervix was uninjured.

The dose necessary to destroy carcinoma in the parametrium has not been determined absolutely, but the parametrium and the organs bear 110 per cent of an erythema dose well and good results have been reported from its use, so that it may be accepted as the correct dosage. The object is to irradiate the whole territory affected by the carcinoma with this dose. The territory of the carcinoma is about identical with the middle parametric connective tissue. This parametric connective tissue body on each side is the shape of a pyramid or cone with its tip at the cervix and its base at the wall of the pelvis. The figure projected on the wall of the abdomen is that of a bird or butterfly. Pneumoperitoneal roentgenograms give a good view of the site of the carcinoma in the pelvis.

In every case of carcinoma of the cervix the author recommends a preliminary irradiation with radium, the radium being moderately filtered in the cervix and body of the uterus, certainly without a rubber covering, and well filtered in the vagina in front of the portio. He recommends the Stockholm method of irradiation, only instead of 40 mg. only 20 mg. is placed in the body of the uterus and instead of 80 mg. only 40 mg. in the vagina. Duration of irradiation 120 hours in 6 days, 20 hours per day. After about four days roentgen irradiation is given from the abdomen and back through a triangular field with a surface of 180 sq. cm. This field is covered with a graduated secondary filter of 2 mm. Al, 3×0.2 mm. Cu and 1×0.5 mm. Cu. The form of this filter corresponds to the field of dissemination of the carcinoma. The primary tumor and cervix are protected while the parametrium is given doses that increase progressively toward the wall of the pelvis. The filter is placed on the patient's skin in such a way that the middle point lies just above the symphysis, all inequalities in the abdomen and the space between the mons veneris and the thighs being filled in with pulverized paraffin. With the use of this filter it is possible to decrease the surface dose by about 10-20 per cent, while the full dose is preserved at 10 cm. depth and the course of the isodoses corresponds to a certain extent to the isodoses of radium. Of course the skin dose can be increased by about 20 per cent and correspondingly larger doses given in the deep tissues. So from two relatively small fields of only 360 sq. cm. surface doses can be given in the pelvis over the whole field of dissemination of the carcinoma which are large enough to destroy the carcinoma. If 7200 mg-hr. radium cannot be applied, less can be used and correspondingly higher roentgen doses given. If this secondary filter and triangular fields are used, lateral fields may be combined with the dorsal and abdominal ones. They need be only about 6×8 cm. in size, must be centered accurately on the portio or spines of

the ischium and should be given from a distance of 30 cm. In this way the portio can be given 24 per cent of an erythema dose, so it is possible, even with roentgen irradiation alone, to irradiate the pelvis almost homogeneously with from 103 per cent at the portio to 110 per cent at the wall of the pelvis. A supplementary treatment with 1600 mg-hr. radium is enough to give a complete carcinoma dose to the whole pelvis.—*Audrey G. Morgan.*

Blass, Gustaf. Besondere resistenz des Ovars gegen Röntgenstrahlen. (Special resistance of the ovary to roentgen rays.) *Strahlentherapie*, 1930, *36*, 370–372.

Friedrich and Kronig tried to determine the smallest amount of rays that would bring about temporary or permanent sterility. They found that it was about 25 per cent of an erythema dose and called it the ovarian dose. About the same time Seitz and Wintz tried to determine the smallest amount of rays that would definitely bring about permanent sterility. They called this the castration dose. It is 34 per cent of an erythema dose.

But there are some cases in which the ovaries are extraordinarly resistant to irradiation. The author describes such a case in a girl seventeen years of age who came for treatment in a cachectic condition with extreme ascites. She was operated on and a carcinoma of the ovary removed on Jan. 30, 1929. She was sent for postoperative irradiation the first of March. She was given a surface dose of 7 H, or 350 R, about 64 per cent of an erythema dose, corresponding to a focal dose of 150 R or about 28 per cent of an erythema dose. She was then given a half series of 300 R, or about 55 per cent of an erythema dose and a series of 600 R, or about 110 per cent of an erythema dose. In the course of six months she was given almost $3\frac{1}{3}$ erythema doses but up to September there had been no disturbance of the menstrual cycle. This is very remarkable and may have been caused in part by the youth of the patient and the partial fractionating of the doses. But this could not explain it completely and there must have been a special resistance of the ovary.—*Audrey G. Morgan.*

Epstein, A. Beitrag zur Behandlung nach Heidenhain-Fried. (Heidenhain-Fried treatment.) *Strahlentherapie*, 1930, *36*, 170–172.

A table is given showing the results of the Heidenhain-Fried treatment in 161 cases of various kinds of inflammation with good results in 115, no result in 41 and no information in regard to 5. The one death was in a case of furuncle of the upper lip. The patient came for treatment in a severe condition of sepsis with erysipelas of the whole head. In the cases of gonorrheal arthritis the fever fell and the swelling and pain disappeared soon after the irradiation. The one case that did not react to irradiation had been under treatment for a long time and had ankylosis of the joints. There was one case of aspiration pneumonia and 5 of croupous pneumonia sent for irradiation because resolution did not take place or a pleurisy had developed. Irradiation brought about rapid resolution and defervescence. In the exudative pleurisies the fever fell by lysis and the exudate decreased or completely disappeared. In plastic pleurisies irradiation had a particularly good effect on the subjective symptoms. The 2 cases of empyema were in patients who in spite of operation had had long-continued suppuration. There was no improvement on irradiation in these cases. The cases of gangrene of the lung, which were very favorably influenced, were also given general treatment. A gangrene of the feet in diabetes mellitus improved on irradiation combined with insulin and diathermy treatment. Irradiation had no effect in the cases of endocarditis ulcerosa or lenta. One patient with acute otitis media in scarlet fever died of meningitis unaffected by the roentgen treatment. One case of sinus thrombosis with mastoiditis was favorably affected but operation was also performed. In tonsillar abscess roentgen treatment was followed by rapid liquefaction and early recovery after a small incision. One case of parotitis was complicated by a severe septic pneumonia. There was rapid liquefaction after irradiation, the fever fell and there was rapid recovery after a comparatively small incision. In the other case the suppurative parotitis was a part of an advanced severe septic pyemic condition; the patient died. One cure of a bedsore in a woman aged eighty was quite remarkable. In the cases of lymphadenitis in scarlet fever the usual treatment had had no effect but roentgen irradiation brought about recovery. Only severe cases of erysipelas that had resisted the usual methods of treatment were irradiated. In 4 of the 9 cases the effect was very good. In adnexitis about the only effect was decreased pain; permanent re-

sults were not attained until diathermy was used and in some cases temporary castration.

The Heidenhain-Fried treatment should be tried in cases of inflammation in which the usual treatment fails, and often gives success. —*Audrey G. Morgan.*

Altschul, Walter. Die Röntgenbehandlung der Prostata bei Retentio urinae. (Roentgen treatment of the prostate in retention of urine.) *Strahlentherapie*, 1930, *36*, 179–182.

Most authors are rather skeptical as to the results of roentgen treatment in hypertrophy of the prostate and say it should be used only in the beginning stages. But the author reports his results in the treatment of old prostatics with complete retention of urine. He has had 9 cases in men over seventy years of age in such poor general condition that operation could not be considered. They were treated 2½ to 3 years ago so the results may be considered permanent. In two-thirds of the cases the treatment was completely successful and generally after only one treatment. In 2 other cases there was improvement but it is not certain that it was due to the roentgen treatment for similar improvements have been seen on conservative treatment. The last case was one of cancer of the prostate in which there was only temporary improvement and the patient finally died. The author thinks therefore that the indications for roentgen treatment should be extended to this group of cases and in two-thirds of them normal urination was brought about permanently and they no longer had to use the catheter. The only contraindication is in cases in which there is a suspicion of tumor; these cases should be operated on as there is a tendency to early metastasis in tumors of the prostate.—*Audrey G. Morgan.*

Fried, Carl. Die Röntgentherapie der Entzüngungen drüsiger Organe. (Roentgen therapy of inflammations of glandular organs.) *Strahlentherapie*, 1930, *36*, 161–169.

The indications for roentgen treatment in inflammations of glandular organs are the same as in other inflammations. In cases in which there is only redness, swelling, pain and fever and the infiltrated part is not too large (for instance, in mastitis not more than an quadrant of the breast), the treatment prevents progress of the inflammation and abscess formation. The pain stops after a few hours or at most the next day. In twelve to thirty-six hours the fever falls to normal or at least to a subfebrile level. The redness decreases in a day or two and the whole infiltration disappears in three to four days. Heat should not be applied to hasten abscess formation; physicians should learn that suppuration can be prevented if roentgen treatment is given in the stage of simple infiltration. Early cases give the best results. But if the patient comes for treatment when the skin is already marbled from the use of heat there is danger of injuring it by roentgen treatment. Great care should be used in giving irradiation in cases in which heat has been used and they should not be irradiated at all until at least twenty-four hours after the application of heat has been stopped. And heat should not be used after irradiation for, aside from the fact that the skin may be injured, heat will cause abscess formation while the object of irradiation is to prevent suppuration.

In cases in which suppuration has begun it is possible that the small pus foci may be absorbed and the course of healing be the same as in irradiation in the stage of infiltration. The author has seen this happen in inflammations of the parotid gland, the breast and testicle. If it is to late to prevent abscess formation it takes place more quickly than without irradiation, and after the abscess is evacuated granulation and healing take place more quickly. In advanced stages of suppuration roentgen treatment is useful also provided the pus is evacuated first. Irradiation should be given either shortly after evacuation or immediately before it. Pain and fever stop and healing takes place quickly.

The author has irradiated 31 cases of parotitis, among them 5 chronic cases. The results were very good in 13 cases, or 41.9 per cent, good in 11 or 35.48 per cent, doubtful in 3, or 9.67 per cent, there was no result in 2, or 6.45 per cent, and the outcome is not known in 2 cases. He has irradiated 3 cases of strumitis with good results in all. He has irradiated 30 cases of mastitis, among them 2 subacute and 3 chronic ones. Among the 25 acute cases 23 were puerperal, 4 of them bilateral. The results were very good in 15, or 50 per cent, good in 8, or 26.67 per cent, doubtful in 4, or 13.35 per cent, negative in 2, or 6.6 per cent, and unknown in one. He has treated 7 cases of orchitis and 7 of epididymitis. In one case the irradiation was ineffective, one case was not followed up to the end but in all the rest the results were good. His material includes only one

case of acute prostatitis and the result was doubtful. He has recently irradiated the prostate through the perineum in 2 cases in which the patients had pain in the prostate and posterior urethra. The results were good in both.

The average dose for inflammation is 160 R. This is a good dose for the submaxillary gland, thyroid and prostate. It is too large for the testicle and epididymis; 100 to 120 R is enough for these glands and in traumatic inflammation of the testicle because of the great tendency to suppuration it is better not to give more than 75 to 80 R. For parotitis and mastitis about 200 R should be given. The technique for inflammation of the glands is the same as in other inflammations.—*Audrey G. Morgan.*

Fukase, Shuichi. Studien über entzundungsprophylaktische Bestrahlung. (Studies on irradiation for preventing inflammation.) *Strahlentherapie*, 1930, *36*. 95–101.

The author made experiments on rabbits to determine whether there is a difference in the biological action of roentgen irradiation of different wave lengths when the same intensity is used. Reports of different authors on this point have been contradictory. He made superficial incisions on the backs of 10 rabbits extending only into the cutis. In 5 of the experiments a zinc filter was used over half the incision and an aluminum filter over the other half. In the other 5 part of the wound was covered with lead, a zinc filter was used on part and an aluminum filter on part. The aluminum filter was 3 mm. thick, the zinc filter 0.5 mm. The irradiation was given with 3 ma., and 170 kv., with a focus-skin distance of 30 cm. The dose gven was about 350 R. There was more marked inhibition of inflammation at the places irradiated with hard rays than at those irradiated with soft rays.—*Audrey G. Morgan.*